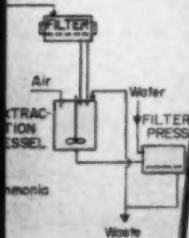


MARCH  
1951

# Chemical Engineering

O REACTION

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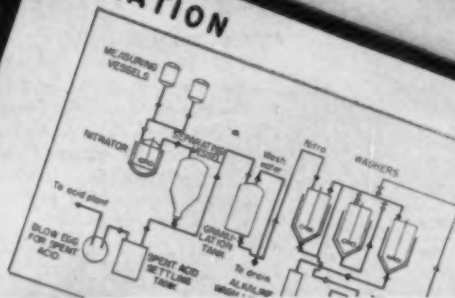
WHAT'S NEW  
IN UNIT  
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**UNIT PROCESSES** WHAT'S NEW IN ORGANIC SYNTHESIS. SOME HIGHLIGHTS OF RECENT ADVANCES IN THEORY & PRACTICE. NEW PERSPECTIVES, PREDICTIONS. **PAGE 129**



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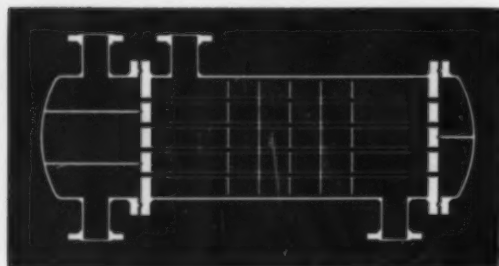
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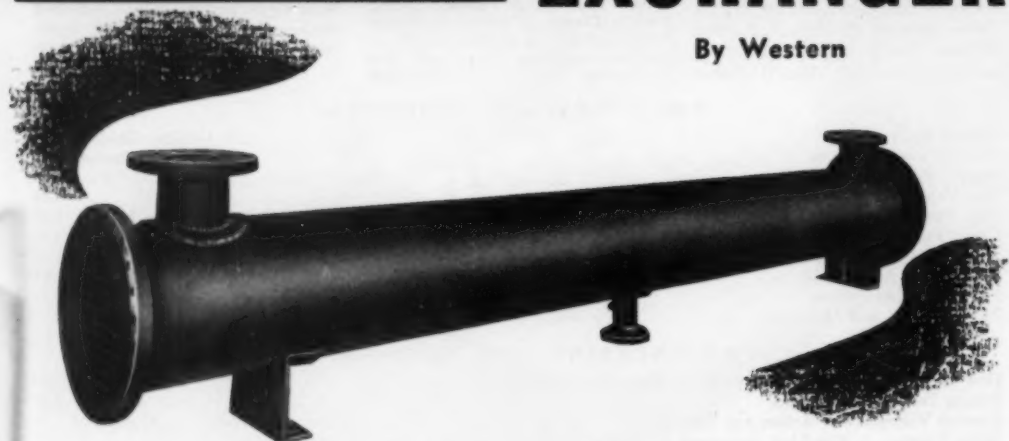
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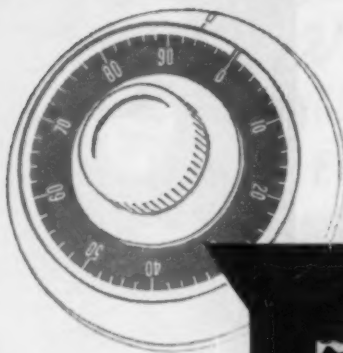


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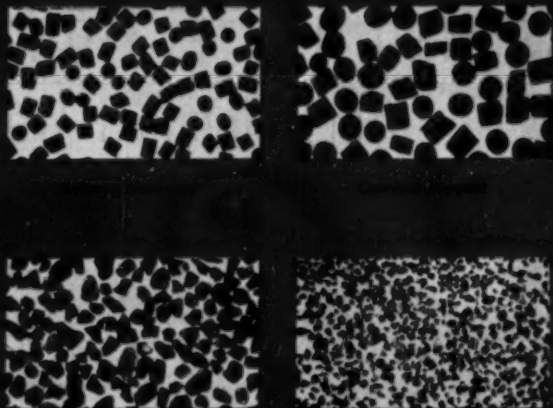
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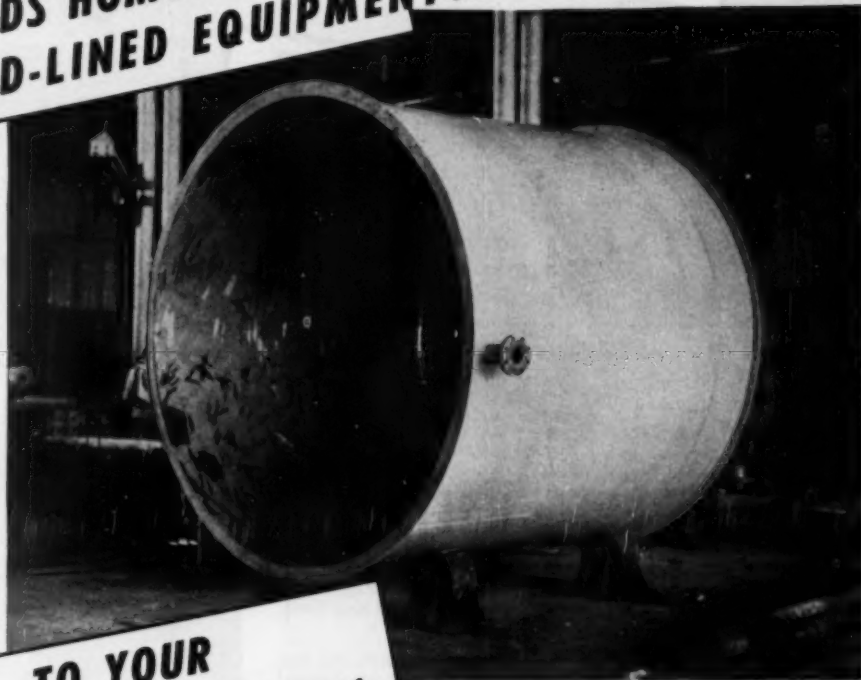
"705" GOGGLE

\*Inhalation and exhalation valves prevent fogging and steaming. Inhaling, air stream removes moisture before it can fog. On exhaling, inlet valve closes, moist air escapes via exhalation valve.

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# Gunthard BUILDS HOMOGENEOUS LEAD-LINED EQUIPMENT.....



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● This vessel, a 10' x 15' homogeneous lead-lined sludge processing vessel, was fabricated and installed for one of the world's largest petroleum refineries, located in the Midwest.

Homogeneous lead-lined equipment by Gunthard, specified here in order to eliminate breakdowns and thus reduce costly shut-down time to a minimum, quickly resulted in savings in excess of the original cost of the vessel.

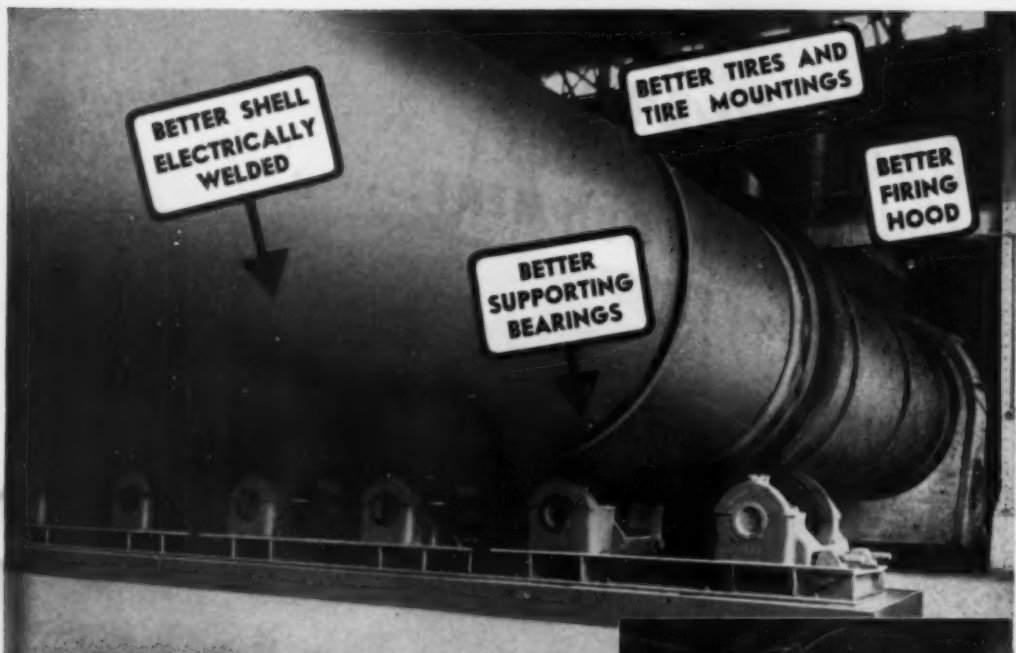
The Gunthard organization has every facility for fabricating homogeneous lead-lined equipment—

from 2 inch carbon steel fittings and all sizes of tanks and vessels, up to massive 90 foot towers. Skilled personnel fabricate equipment of every type from ferrous and non-ferrous metals including aluminum, stainless, stainless-clad and carbon steels.

We number among our regular customers many of the largest and most progressive chemical processing companies in the nation. If you have a problem that might be solved by expert metal fabrication—with or without lead lining or covering—we invite you to write for complete information on how Gunthard engineering services and facilities can be of provable cost-cutting value to you.

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## TROUBLE-FREE OPERATION

Is the most important factor in keeping Rotary Kiln Costs down — and profits up. One breakdown can easily offset all of the savings achieved through careful firing and feeding for a long period of time.

That's why every part of every Vulcan Kiln is designed and built with an extra margin of protection against mechanical troubles of any kind and that's why long-time users of Vulcan Rotary Kilns, Coolers, Dryers, Retorts, etc. often order additional units from us without competition. They know that any necessary difference in first cost will be repaid many times over in greater freedom from breakdowns, shutdowns and other operating expense.



### This Booklet Tells Why Vulcan Kilns Are Better

and why they give more years of trouble-free service. It's 28 fully-illustrated pages are packed with specific information regarding the design and construction of Vulcan Rotary Kilns, Coolers, Dryers and other related products. No charge or obligation. Write for Bulletin No. A-442. Give name of your company.



The illustrations above show a typical installation of Vulcan Rotary Kilns in a modern cement mill. Note the simple, sturdy design and construction — the entire elimination of any features that might invite mechanical trouble. The improved-type firing hoods were designed for burning pulverized coal but can easily be adapted for burning either gas or oil.

# Vulcan Iron Works

Established  
1849

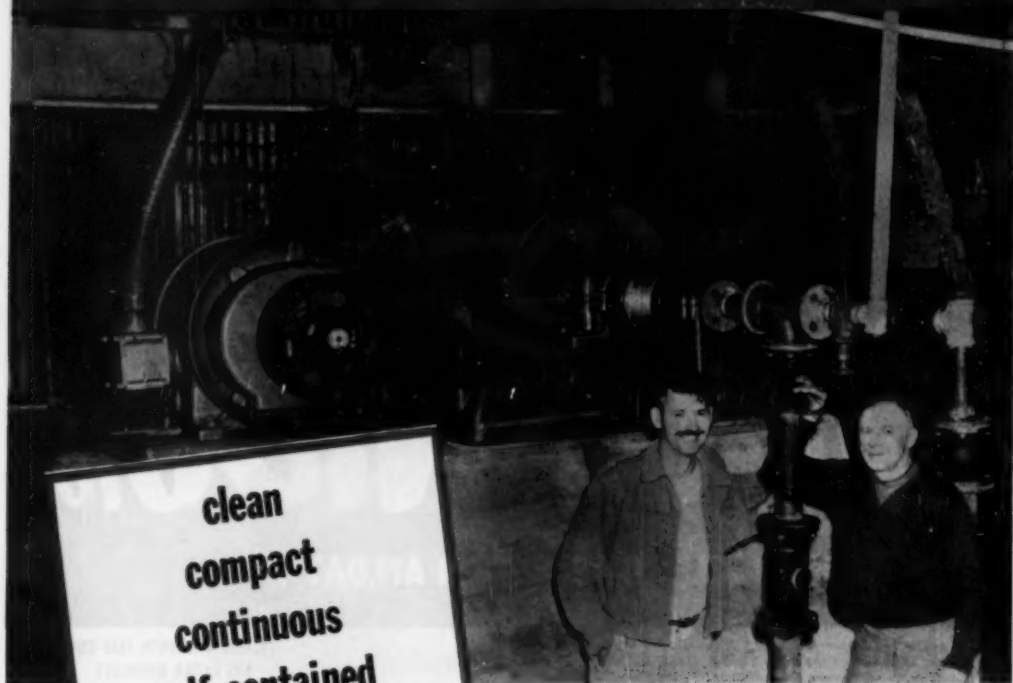
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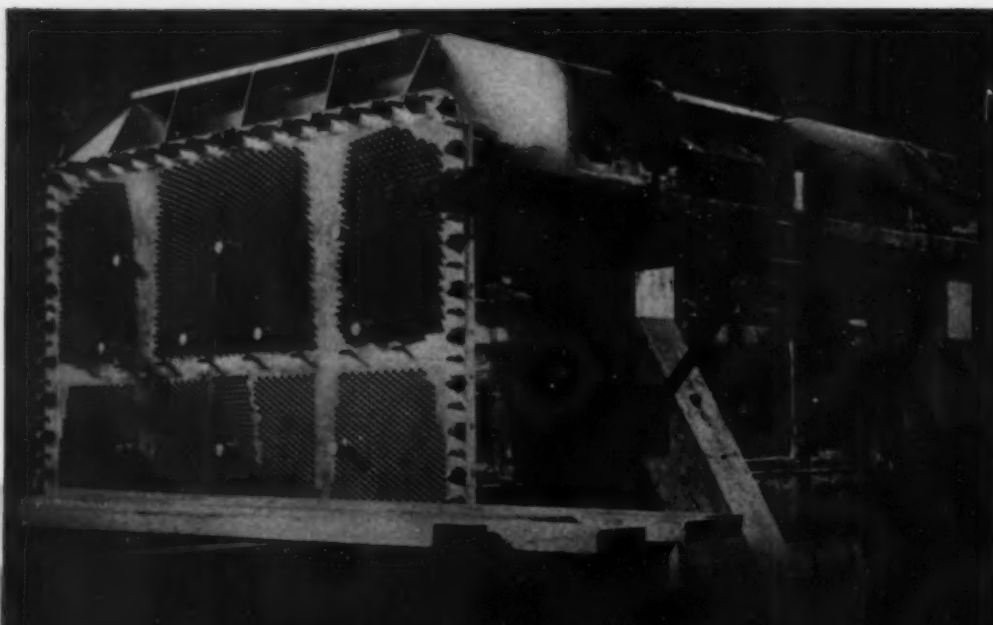
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THE UNBEATABLE COMBINATION AFLOAT \*

*A main condenser for MSTS Transport President Hayes in the shipyard of the New York Shipbuilding Corporation, Camden, N. J. Revere Cupro-Nickel Tubes (30% nickel) are used. The tube plates are Muntz Metal.*

\*AND WHEREVER ELSE CONDITIONS  
ARE EXTRA DIFFICULT

**C**UPRO-NICKEL is the preferred alloy for condenser tubes in marine use because of its superior resistance to the corrosive influences of sea and harbor water, the latter usually contaminated with extremely active industrial and sewage wastes. Thus it is natural that cupro-nickel, 30%, is being used for the tubes in three vessels now being completed by the New York Shipbuilding Corporation, Camden, N. J. These ships were originally ordered for the American President Lines, Ltd., for passenger and cargo service, but subsequently taken over for military service. The builder constructed the condensers at its yard, and Revere furnished the tubes and plates.

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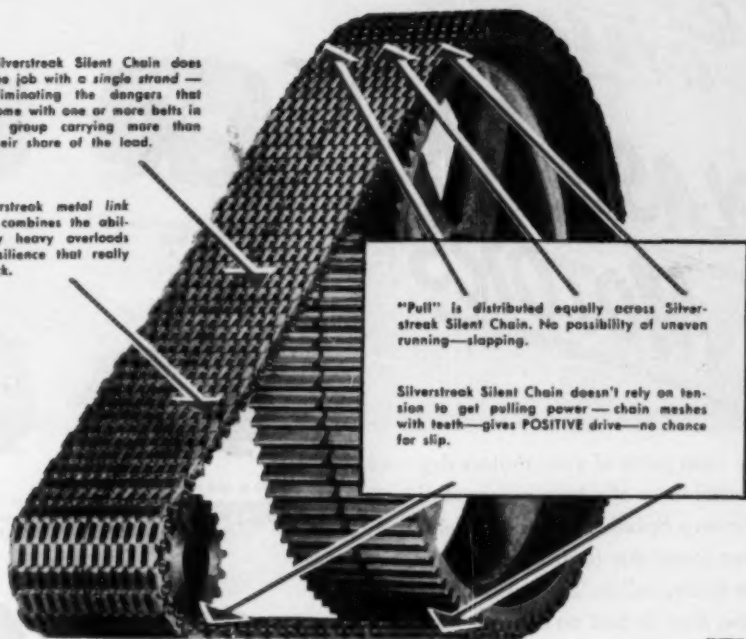
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Silverstreak Silent Chain doesn't rely on tension to get pulling power — chain meshes with teeth—gives POSITIVE drive—no chance for slip.

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Yes, get the amazing, trouble-free efficiency of 98.2%. A standard of operation that continues throughout the long, long life of the drive. More than this — every rating and design is backed by a record of *proven performance*. And every chain is engineered for the job. You conserve space, too —

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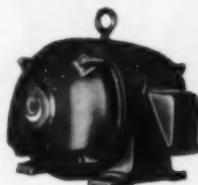
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Celanese has abundant resources of natural petro-

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CHEMICAL ENGINEERING—March 1951

13

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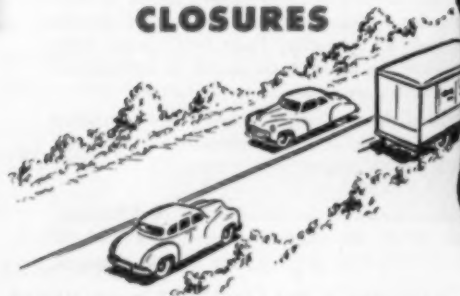
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TRI-SURE PRODUCTS LIMITED • ST. CATHARINES, ONTARIO, CANADA

\*The "Tri-Sure" Trademark is a mark of reliability backed by 28 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure discs), Plugs and Seals have been used.

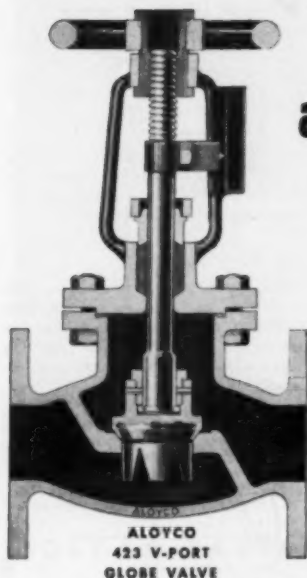
**Every Quaker State drum  
is equipped with**

**Tri-Sure**  
Reg. U. S. Pat. & TM.  
**CLOSURES**





**ALOYCO 20 No. 423 V-Port Globe Valves** control recirculation and transfer of acid to plant storage...thence, eventually, into the making of explosives, pharmaceuticals, petroleum products, etc., where product purity is paramount. Valves in foreground handle oleum, in the center 98%  $H_2SO_4$ , in the back 93%. Temperature range from 85° F. to 180° F. A few Gate Valves—our No. 111—are also shown.



## They Give American Cyanamid a Much Longer Run for Its Money

The photograph above shows a few of the ALOYCO valves that handle the large daily output of sulfuric acid at American Cyanamid Company's Warners plant at Lin-

den, New Jersey. Though such valves themselves represent a small item of total plant investment, *entire plant operation depends upon them.*

### Continuous Use for Nearly 2 Years

*These ALOYCO valves have been in uninterrupted service 24 hours a day—without the slightest maintenance—since the unit went on stream April 8, 1949.*

Such performance explains why this American Cyanamid plant has for years standardized on ALOYCO

valves for corrosive service.

If your plant deals with corrosives or must guard everywhere against product contamination, think of ALOYCO valves—and Alloy Steel Products Company. Our engineers will welcome the opportunity to work with you.



**ALLOY STEEL PRODUCTS COMPANY, INC.**

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## HOW A SMALLER FEinc FILTER

...Does a Bigger Job!

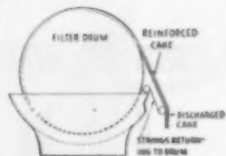
Because it does away with costly slow-downs due to filter cloth blinding—and eliminates stoppages necessary to change cloth that's worn out by a scraper—the FEinc continuous (really continuous) rotary vacuum filter gives higher filtration rates per square foot with less maintenance—and that's what counts! For instance, these actual cases:

Two scraper-type filters handling black iron oxide ran partially blinded. The resulting mud was wet, due to the heavy blow-back which returned some filtrate to the cake in attempting to free the fine solids. The same job is now handled on just one FEinc, with no plugging, and dry cake.

Zinc oxide formerly came off a scraper filter so wet it had to be shoveled onto an intermediate drum dryer. Now a FEinc string filter eliminates the intermediate dryer, drops cake directly onto the final dryer's conveyor.

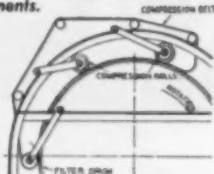
A porcelain plant reported costs reduced 59% by one FEinc continuous filter producing cake with uniform 17% moisture, as compared with four plate-frame presses formerly used.

Lighter, more efficient fabrics last longer on the FEinc String Filter, give you clearer filtrate, lower loss of solids. Then too, the FEinc compression mechanism removes 2-6% more moisture, and the FEinc submergence washing mechanism washes cakes down to unbelievable purity. Any combination of FEinc features can be engineered to your needs at reasonable cost. Ask for Bulletin 103.



Note how the FEinc String Discharge reinforces the filter cake and removes it from the filter drum in one continuous, easy-to-handle sheet.

FEinc compression mechanism, consisting of belt and rolls, gets more moisture out of cake than vacuum could do alone. Rolls seal cracks in cake which reduces vacuum requirements.



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No. 12—The Analysis of Liquid Chlorine and Bleach  
No. 14—Chlorine Bleach Solutions



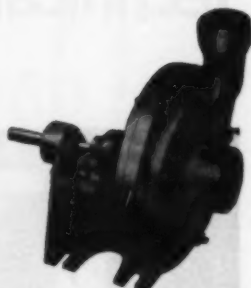
Soda Ash • Caustic Soda • Caustic Potash • Chlorine • Potassium Carbonate • Calcium Chloride • Sodium Bicarbonate • Specialty Cleansers • Sodium Nitrite  
Nytrol • Ammonium Bicarbonate • Para-dichlorobenzene • Ortho-dichlorobenzene • Monochlorobenzene • Methanol • Ammonium Chloride • Formaldehyde

CHEMICAL ENGINEERING—March 1951





# It's easy to get the right pump!



*Gardner-Denver Side-Suction Centrifugal Pump*

Call your Gardner-Denver field engineer. He'll gladly work with you in planning the most economical and efficient pumping layout. And he's an expert at specifying the correct pump for every installation.

He may recommend the compact Gardner-Denver Close-Coupled Centrifugal, which may be installed in many positions—or the easy-to-hook-up Gardner-Denver Side-Suction Centrifugal—or the heavy-duty Gardner-Denver Double-Suction Centrifugal. All Gardner-Denver pumps are built in a wide range of capacities—can be furnished in corrosion or abrasion resisting materials when required.

Write us today for complete information. Ask for the name and address of the Gardner-Denver pumping engineer nearest your plant.



*Gardner-Denver Close-Coupled Centrifugal Pump*



*Gardner-Denver Double-Suction Centrifugal Pump*

SINCE 1859

## GARDNER-DENVER

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

# STANDARD'S SERVICE-SUPPLY CENTERS



# NOW more important than ever to you

You are, or may soon be, shifting your production setup to meet the country's rearmament needs. New machines, new operations, and faster production schedules will demand some revision of your lubrication practices. That's why Standard's Service-Supply organization is now more important than ever to you.

Standard has a service-supply warehouse within a short truck-hauling distance from your plant.

If you are a Standard Oil customer this warehouse will stock every lubricant used in your plant. Deliveries can be made in a few hours if necessary.

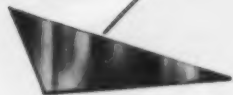
In addition, this service-supply center is headquarters for a Standard Oil lubrication specialist who is assigned to your plant. He is close at hand to give you help when you need it. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

To arrange for his visit, phone your nearby Standard Oil Service-Supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

**STANDARD OIL COMPANY (INDIANA)**



What you can do to make the supply of Stainless Steel  
go further



# Tell your supplier exactly where you'll use Stainless and how you'll fabricate it

## Keep these points in mind, too, when you order Stainless

Minimize your scrap losses by ordering alternate multiple sizes that will cut to best advantage, and that will allow the mill to utilize the maximum amount of good material.

Indicate, if possible, acceptable alternatives in composition, gage, size and finish.

"Second guessing" and "trial-and-error" specification of Stainless Steel are out of the question today with this vital material in such restricted supply. It's up to you to do everything possible to get the right Stainless and then use it right.

Your supplier—no matter who he is—can give you valuable help in this matter. He knows the advantages and the limitations of the various Stainless grades. And, since the supply picture varies from grade to grade, he may be able to suggest an alternate composition that will speed up delivery and give equally good or better results.

Your supplier knows the fabricating characteristics of Stainless grades, too. Consequently, he may be able to suggest slight changes in your fabricating procedure that will speed up or simplify production. In other words, the better he understands your problem the better able he is to give you the Stainless that will do the best job for you with the least trouble and delay.

So give your supplier all the facts. And don't forget to include a definite date for delivery . . . the date when you actually plan to use the material. It will help to distribute supplies as equitably as possible.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND • COLUMBIA STEEL COMPANY, SAN FRANCISCO

NATIONAL TUBE COMPANY, PITTSBURGH • TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM • UNITED STATES STEEL COMPANY, PITTSBURGH

UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST • UNITED STATES STEEL EXPORT COMPANY, NEW YORK



## U·S·S STAINLESS STEEL

SHEETS • STRIP • PLATES • BARS • BILLETS • PIPE • TUBES • WIRE • SPECIAL SECTIONS

UNITED STATES STEEL

8-384





## WHY RISK **THIS** TO SAVE A DIME A WEEK?

Expensive re-running in many a plant—whether it makes gasoline, drugs or heavy chemicals—thrives on poor temperature control. And the margin is often narrow . . . a variation of only a few degrees meaning thousands of dollars in slop material or damaged equipment.

Yet many plants risk this loss without realizing it! They attack the temperature control problem correctly, by using potentiometer pyrometers to get top accuracy and dependability. But they sometimes slip on the "standardizing" adjustments which such instruments need to maintain those qualities. Overlooking the need for frequent and regular standardizing, these plants permit the operation to be done by hand . . . and thus possibly skimped or forgotten.

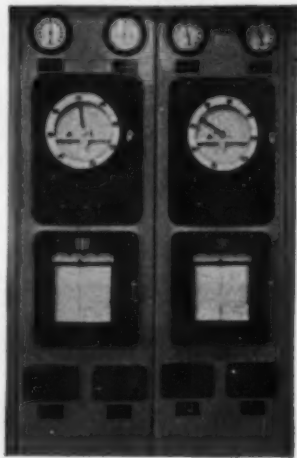
There is just one way of removing this threat to the accuracy of process temperature. It's by putting the standardizing responsibility where it belongs . . . directly on the recorders and controllers themselves.

A relatively simple device, the automatic standardizer, should be built into the potentiometer to handle this job. It checks the measuring circuit at least every 48 minutes . . . adjusts when necessary without upsetting the process . . . *never forgets!* And this essential feature, amortized in the usual 10 years, costs less than 10¢ a week!

So, regardless of what make instruments you buy, be sure to specify automatic standardizing. It's cheap . . . safe . . . sure!

Write Leeds & Northrup Company, 4916 Stenton Ave., Phila. 44, Pa.

**AUTOMATIC  
STANDARDIZING**  
Guards Product Quality  
When You Use Instruments  
Like These

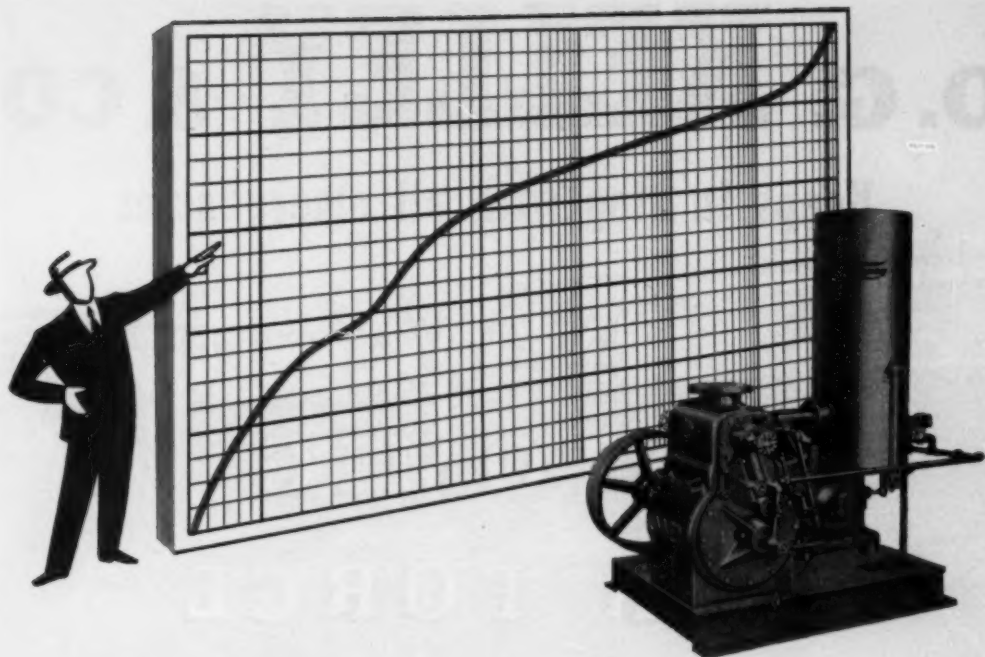


Four out of the 17 Speedomax Controllers which help maintain production of one process unit in an Eastern chemical plant.

Jrl Ad ND4(3a)

**LEEDS & NORTHRUP CO.**





## HERE'S VACUUM PERFORMANCE!

In vacuum processing performance counts — and no pump can give you better performance than a Kinney Vacuum Pump. High pumping speeds, efficient use of power, extremely low ultimate pressures, and dependability that's unsurpassed — these are the reasons why you'll find Kinney Vacuum Pumps in such a large percentage of all vacuum processes. Kinney Pumps help to create the low absolute pressures needed to produce light bulbs, electronic tubes, vitamin concentrates, penicillin, malleable titanium, dehydrated foods, costume jewelry, and scores of other up-to-the-minute products. Whether your problem involves laboratory, pilot plant, or full scale

production, it will pay you to get Kinney Vacuum Pumps. Kinney engineers will gladly show you performance records of Kinney Pumps on jobs like your own. Send coupon for complete details today! KINNEY MANUFACTURING COMPANY, Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle.

**FOREIGN REPRESENTATIVES:** General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England . . . Horrocks, Roxburgh Pty., Ltd., Melbourne, C. I. Australia . . . W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa . . . Navelectric, Ltd., Zurich, Switzerland . . . C.I.R.E., Piazza Cavour 25, Rome, Italy.



### SEND COUPON TODAY

KINNEY MANUFACTURING CO.  
3551 WASHINGTON ST., BOSTON 30, MASS.

Gentlemen:

Please send illustrated Bulletin V45. We are interested in:

- |   |  |
|---|--|
| <input type="checkbox"/> Vacuum exhausting  | <input type="checkbox"/> Vacuum distillation |
| <input type="checkbox"/> Vacuum coating     | <input type="checkbox"/> Vacuum metallurgy   |
| <input type="checkbox"/> Vacuum dehydration |  |

Name \_\_\_\_\_ Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

# O. G. KELLEY & CO.

Keeps in step with all emergencies

NAVY  
ATOMIC  
AIR FORCE  
CHEMICAL  
ORDNANCE

Kelley "know how"

builds equipment that serves the world

BIKINI — OAK RIDGE — BROOK HAVEN — MANFORD WORKS

BACTERIOLOGICAL WARFARE — WHOLLS ATOMIC — INCONNE

KELLEY

STAINLESS STEEL  
ALUMINUM  
AND OTHER  
ALLOY  
METALS

FOREIGN INQUIRIES SOLICITED

## O. G. KELLEY & CO.

ENGINEERS

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CLEVELAND, OHIO

NEW YORK, N.Y.

PITTSBURGH, PA.

JOHNSON CITY, TENN.

HOUSTON, TEXAS

ELIZABETH, N.J.

# Reeves vari-speed Motodrive

**your best buy in a complete  
variable speed power plant  
here's why:**

**1** A complete, self-contained variable speed power plant combining motor, REEVES speed varying mechanism and speed reducer in one, space-saving unit.

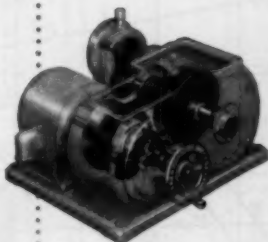
**2** Available with any standard, constant-speed, foot-type motor—the same as motors on your other machines—no stocking of special motors.

**3** Easily applied to machines in service. Horizontal and vertical models; speed ratios 2:1 through 6:1; sizes 1 to 20 hp; manual or automatic controls. Fractional hp units also available in ratios up to 10:1.

**4** REEVES operating principle—proved in 300,000 installations—assures *positive, accurate* speed changes without stopping machine.

For your machines, new or old, specify REEVES Speed Control and secure all the benefits of stepless speed adjustability. For full information, send for catalog No. CE64-509.

## Here Is How It Works



Phantom view of horizontal model  
with single reducer.

The Motodrive utilizes a proved REEVES operating principle of a V-belt driving between two pairs of cone-shaped discs which are adjustable to form an infinite number of driving and driven diameters. Discs are mounted on parallel shafts. One shaft receives power at constant speed from motor—other delivers power of infinitely adjustable speeds to gear reducer from which desired speed is transmitted to driven machine.

**REEVES PULLEY COMPANY • COLUMBUS, INDIANA**  
Recognized leader in the specialized field of speed control engineering

accurate • variable  
**REEVES** Speed Control

## PROBLEM...

To help papermakers formulate high-solids pigment casein coatings to be applied by high-speed roll coaters, without causing surface patterning, unevenness, and other imperfections.



## SOLUTION...

The Hercules High-Shear Viscometer—which accurately measures and charts the complex flow characteristics and behavior of high-solids pigment suspensions to an extent previously unobtainable, thereby helping papermakers to design coatings for performance on high-speed coating processes.

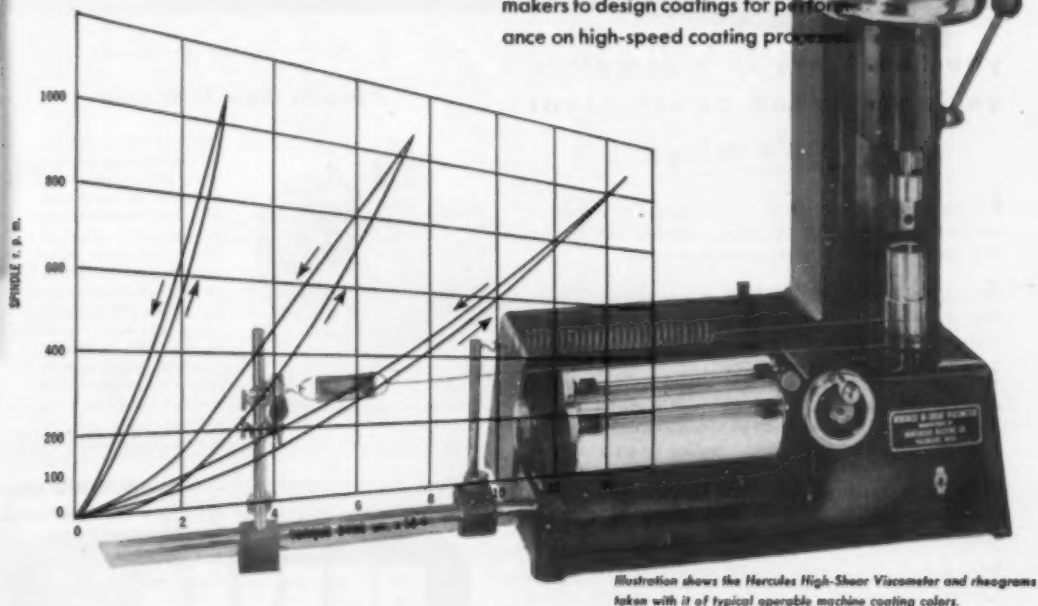


Illustration shows the Hercules High-Shear Viscometer and rheograms taken with it of typical operable machine coating colors.

SYNTHETIC RESINS • CELLULOSE PRODUCTS • TERPENE CHEMICALS • ROSIN AND ROSIN DERIVATIVES

## The Hercules High-Shear Viscometer

Developed by Hercules, in its own laboratories for research on high-speed casein coatings, the High-Shear Viscometer is now used by many paper mills. Other industries also are finding this instrument to be a valuable addition to their research equipment. These process industries are using the High-Shear Viscometer to better predetermine the performance of such products as adhesives, paints, ceramic compounds, and printing inks where these are subjected to high rates of shear or agitation in manufacture or use.

This development is typical of varied approaches used by Hercules in application research for its chemicals . . . with a view to improving their working characteristics and broadening their field of application.

**HERCULES POWDER COMPANY** 952 Market Street, Wilmington, Del.  
Sales Offices in Principal Cities

### RESULT...

High-quality casein bonded coated paper for offset printing can now be produced faster and cheaper. In addition, the advantages of brightness, bonding strength, waterproofness, and printability characteristics of casein are now permitted in high solids machine coatings.



### New Experiment Station Wing

A new 3-story wing addition to its main laboratory building near Wilmington is the latest expansion by Hercules in its research facilities over the past five years. The new wing provides 26 new laboratory units accommodating 51 chemists, and increases working space in the main laboratory building by 60%.

These increased facilities include two new air-conditioned laboratories for testing paper and textiles. Two new laboratories have been provided to house microanalytical research equipment. Two laboratories are earmarked for physicists for spectrometry, and to house a newly acquired mass spectrometer. A specially designed laboratory has been set up for work on hot lacquer.

### Try This for Size

A new and simplified automatic emulsifier for rosin size has just been introduced to the paper trade by Hercules. Lower in price than the original emulsifier introduced by Hercules in 1948, the new unit meets the need for a still more economical and simplified process.

The new unit, like the original unit, offers paper mills savings in labor costs and space requirements. It provides rosin emulsions of greater uniformity of concentration and quality.

Paper mills may obtain specific details on cost, layout, construction, and other pertinent information by writing to Hercules.

### Conserve Scarce Phenolics

Technical data indicating the opportunities that low-cost "Vinsol"® resin offers in conserving phenolics are included in a new booklet "Hercules Vinsol Resin, A Modifier of Thermosetting Phenolic Resins." Today, especially, it will pay you to evaluate "Vinsol", as a phenolic extender or modifier. Priced at less than 5¢ per pound, this dark-colored, high-melting thermoplastic offers substantial savings in total resin costs.

At present, many Hercules chemical materials are not available. This advertisement is intended to keep you informed of latest developments, and to suggest possible future applications in your business.

CHLORINATED PRODUCTS • OTHER CHEMICAL MATERIALS FOR INDUSTRY

# HERCULES

CHEMICAL ENGINEERING—March 1951

GCS1-2

27





**In 10 years**

*...not one cent for maintenance*

That's the remarkable performance of ENDURO Stainless Steel kettles used to "cook" resins in the manufacture of high-grade varnish.

Kettles previously used (not stainless steel) averaged only about two years of service in the 575-degree heat. With ten years of uninterrupted service already behind them, these ENDURO kettles appear good for at least ten more.

Over a ten-year span of almost daily use...no maintenance...no need for replacement! Here, as in so many other cases, ENDURO process equipment has more than paid its way in material savings alone. Actually, it has helped conserve critical materials.

What's more, varnish produced in ENDURO

kettles has a desirable light color. ENDURO is non-contaminating—in no way affects product quality.

ENDURO kettles are easy to clean and to keep clean, too. Daily boiling out with caustic has not corroded them. ENDURO resists the action of most alkalies and acids.

Competent Republic Metallurgical Service is standing by to help you use ENDURO to best advantage. The service is completely confidential and without obligation. Just write:

**REPUBLIC STEEL CORPORATION**

*Alloy Steel Division • Massillon, Ohio*

**GENERAL OFFICES • CLEVELAND 1, OHIO**

Export Department: Chrysler Building, New York 17, New York

*Republic*  
**ENDURO STAINLESS STEEL**



Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Bolts and Nuts, Tin Plate, Taping, Stevens Barrels and Drums

# MILESTONES

## ...in ION EXCHANGE

**1912** The Permutit Company was founded to pioneer the application of ion exchange to the treatment of water. This revolutionary process utilized the first synthetic zeolite or ion exchanger, Permutit M, a sodium aluminosilicate.

**1918** Permutit developed a process for stabilizing and increasing the capacity of naturally occurring greensand glauconite. This material, sold as Zeo-Dur, is still the best material known for certain applications.

**1935** Permutit produced the first commercial organic cation exchanger . . . Zeo-Karb. This material was the first that could be operated on both the sodium and hydrogen cycles.

**1937** Permutit manufactured the first resin type ion exchanger, Demineralite, for removing anions from solution. The first commercial demineralizing installation was made employing this material in conjunction with hydrogen regenerated cation exchanger to produce the chemical equivalent of distilled water.

**1943** Permutit made the first mixed bed demineralizing unit for the Armed Forces.

**1944** Permutit developed and produced for the Armed Forces an ion exchange material for making potable water from seawater.

**1946** Permutit was again first with the announcement of a highly basic anion exchanger, Permutit S, and introduced the revolutionary process for making silica-free demineralized water.

**1950** For the latest in ion exchange research, look to the world's sole manufacturer of all types of ion exchangers and equipment.

Send for full information about these or any other ion exchangers and the equipment for their use to The Permutit Company, Dept. CE-3, 330 West 42nd Street, New York 18, N.Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal, Canada.



# PERMUTIT

WATER CONDITIONING HEADQUARTERS FOR OVER 37 YEARS

# WOULD YOU LIKE TO BUY A "SELF-HEALING" BAG CLOSER?

Would you like to have a Bag Closing Machine that never got out of order? ... never broke down? ... that would automatically "heal itself" if any parts began to wear?

Of course you would. A wear-immune and failure-proof machine is the ideal. We never quite achieve it—but we can come mighty close!

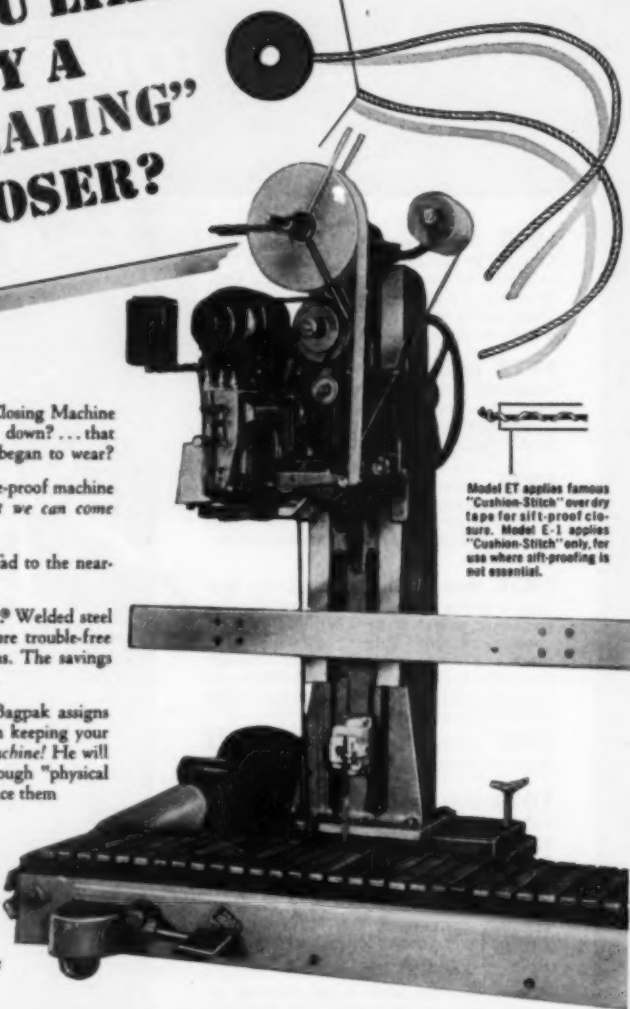
Bagpak has taken two important steps which lead to the near-ideal in Bag Closing Machines.

First, extra strength is built into every Bagpaker®. Welded steel construction and heavy-duty working parts assure trouble-free operation—reduce lost time due to breakdowns. The savings on this alone can be tremendous over the years.

Second—and perhaps the most important—Bagpak assigns an experienced Service Engineer to assist you in keeping your Bagpaker in tip-top shape, *for the life of the machine!* He will make regular visits to give the machine a thorough "physical check-up" ... to look for wearing parts and replace them *before* they can cause a breakdown.

This kind of "preventive service", in addition to the extra serviceability built into every part of every Bagpaker, makes the Bagpak Machine the nearest thing to the ideal Bag Closing Machine you can possibly buy.

For more details about the *better* Bagpaker, write today for booklet 230-E.



Model ET applies famous "Cushion-Stitch" over dry tape for sift-proof closure. Model E-1 applies "Cushion-Stitch" only, for use where sift-proofing is not essential.

## International Paper Company

### BAGPAK

DIVISION

220 East 42nd St., New York 17

BRANCH OFFICES • Atlanta • Baltimore • Baxter Springs, Kansas • Boston • Chicago • Cleveland • Denver • Los Angeles • New Orleans • Philadelphia • Pittsburgh • St. Louis • San Francisco.  
IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa.

# Houghton's New Chemically Unique Surfactant



## Surfax 1288

**...outstanding as an  
exceptionally effective  
Wetting Agent**

Surfax 1288 . . . an exclusive development of Houghton research . . . is outstanding for wet processing applications where a fast, efficient wetting agent is indicated. A water-soluble reddish-amber liquid, Surfax 1288 is chemically an *alkylaroyl sulfopropionic ester*. It is unsurpassed as a wetting agent . . . possesses rewetting properties . . . but has no marked detergent ability. It is anionic in nature; in neutral or mildly alkaline solutions Surfax 1288 performs with remarkable speed and effectiveness. Highly concentrated, it offers many cost-saving advantages wherever wet processing is employed. We urge you to investigate its advantages for your particular applications. For Data Sheet on Surfax 1288 write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

### THE HOUGHTON LINE OF SURFACE ACTIVE AGENTS

... a good line to know! These detergents and wetting agents are the result of 15 years of Houghton research to develop surface active agents with extra advantages for your specific applications. The "Cerfak" group is outstanding for detergency . . . the "Surfax" group is famous as wetting agents . . . but many combine both properties. The line includes five CERFAK and two SURFAX products having a wide range of applications throughout industry. What is your problem?

### SURFAX 1288

... a product of

**E. F. HOUGHTON & CO.**  
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO



Ready to give you  
on-the-job service . . .

overcoming geographical barriers

a fatty acid  
fractionating

plant...designed, fabricated, erected



The fatty acid fractionating plant is one of more than 20 industrial equipment units which have already been shipped from the United States of America to Norway where a Foster Wheeler fatty acid distillation unit will be installed. This unit will be similar to one of the model plants designed, engineered, and constructed by Foster Wheeler for Amstar & Company. These specialized pieces of equipment were manufactured at Foster Wheeler plants and include, with items on board, condensers, reboilers, heat exchangers, a 3,000,000 Btu Deaerator Vaporizer and condenser, condenser, pumps, and general accessories.

FOSTER WHEELER CORPORATION  
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER  WHEELER





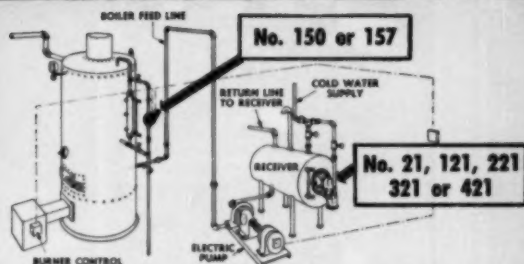
### Pump controllers

Highly perfected and proved in thousands of installations, the McDonnell No. 150 is the pump control for boilers with steam pressures up to 150 lbs. Convenient terminals provide circuits for pump motor (or starter), for low water cut-off of burner, and, when desired, for low water alarm. No. 157 (at right) is the same dependable control with integral water column which greatly cuts cost of installation under many conditions.



### Receiver tank make-up feeders

To provide make-up water when insufficient condensate is returned to the tank, dependable McDonnell make-up feeders are available. Simplest form when adaptable is the No. 21 series (at left) which is installed right in receiver tank and feeds water directly. Four flange shapes and sizes are provided in this series (Nos. 21-121-221-321) to fit openings in most tanks. The No. 421 (at right) takes care of conditions where installation with equalizing piping is necessary. These quality feeders seat drip-tight against high water pressures.



### —but no need to SCRAM with dependable boiler water level control

A steam boiler without automatic boiler water level control is strictly a "Sam-you-better-scrum" deal. But there's no need to scram when the job of safeguarding the boiler is taken over by the simple hook-up diagramed above.

It will pay you to study this diagram for a moment and note how the water level (the feed pump) is controlled from the water level itself by a McDonnell No. 150 or 157 pump control. This modern method holds the water level within the close limits that steps up efficiency . . . pays for the control.

An extra switch on the control provides circuits for low water fuel cut-off and low water alarm if a fuse should blow in the feed-pump circuit. The McDonnell make-up feeder on the receiver tank maintains a minimum level in the receiver tank at all times.

Note the facts opposite about the dependable McDonnell equipment that will give you this protection and increased efficiency. Ask for data sheets covering every detail of the simple installation and wiring.

McDONNELL & MILLER, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

*Doing One Thing Well*

# McDONNELL

# NEW TRUCK MOUNTED CONTACTORS Cut Inspection Time!



**N**ow, for the first time, air contactors have been truck mounted! The contactors of this Synchronous Motor Controller are mounted on wheels—easy to remove through front or rear hinged doors. Just disconnect the power leads, unplug the control circuits and withdraw the contactors for easy inspection.

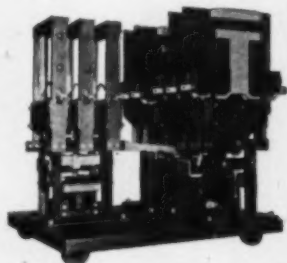
You save space! The starter is smaller because room for inspection isn't needed within the cubicle. Truck mounting is a feature of Type H Starters using three air contactors.

For complete control plus protection of squirrel-cage, synchronous and wound rotor motors up to 1500 hp at 5000 volts . . . all in one attractive steel cabinet that is compact and easy to install . . . specify Allis-Chalmers Type H Starters.

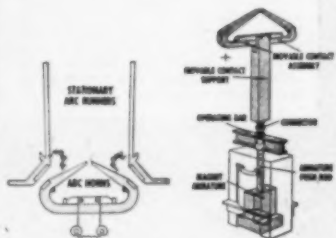
For full or reduced voltage starting, a single starter or an entire control group, check with your nearby A-C representative or send for bulletins 14B6410 and 14B7303.

Allis-Chalmers  
Milwaukee 1, Wis.

A-3107



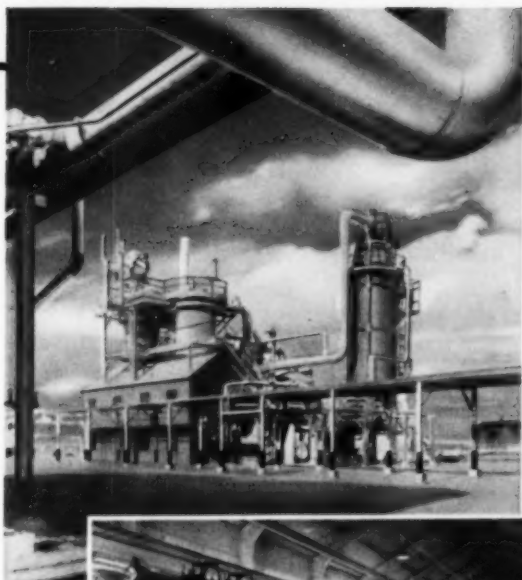
**THREE TYPE 256 AIR-BREAK CONTACTORS** are mounted on a common base of heavy gauge metal . . . mechanically interlocked to provide reversing and dynamic braking for a synchronous motor. Base is on wheels—rolls into cubicle on guide rails. This truck mounting provides for quick, easy, unhindered inspection.



**DOUBLE BREAK CONTACTS AND STRAIGHT LINE VERTICAL ACTION** are combined in Allis-Chalmers Air-Break Contactors to eliminate maintenance factors like flexible contact leads, turning shafts and shaft bearings. These contactors are clean, easy to inspect and maintain . . . accessible in compact, attractive Type H Starters.



## ALLIS-CHALMERS



## NOTHING IS WASTED

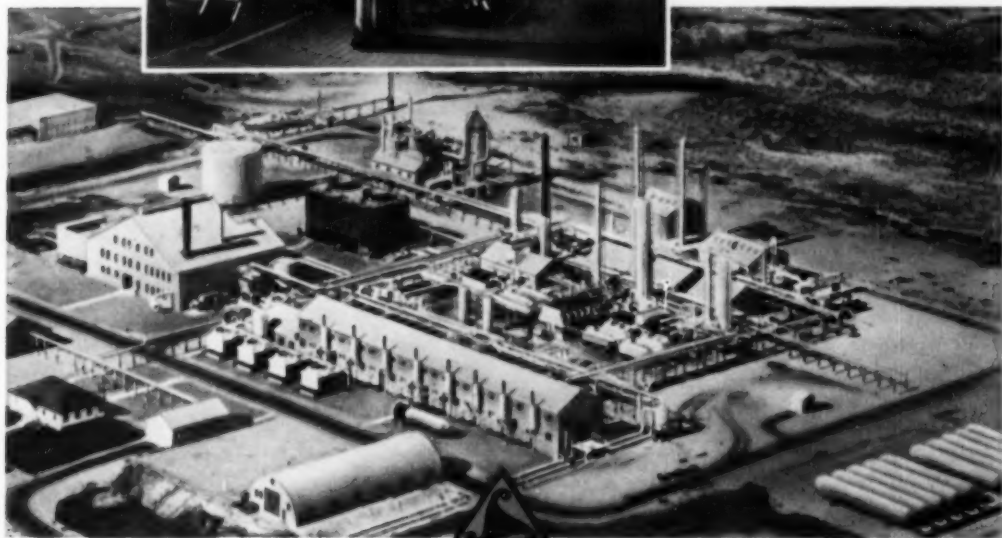
To insure maximum use of the field, the new Elk Basin Unit Repressuring Plant at Elk Basin, Wyoming, includes provision for recovery of over 90 per cent of pure elemental sulfur from sour gas and the generation of flue gas for repressuring. This releases the sweetened natural gas for sale purposes. Operated for the Unit by Stanolind Oil and Gas Company, the plant recovers propane, butane and natural gasoline from casinghead gas. Design and construction were by Stone & Webster Engineering Corporation.



Above: Sulfur Recovery Unit.

Center: Interior of Compressor House showing feed and inert gas compressors.

Below: General aerial view of plant.



**STONE & WEBSTER ENGINEERING CORPORATION**

A SUBSIDIARY OF STONE & WEBSTER, INC.

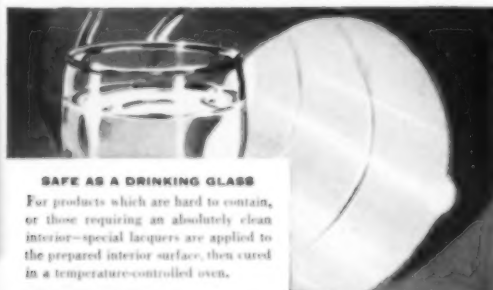


**WORLD'S  
FIRST  
COMPLETELY  
LITHOGRAPHED  
AND INNER  
ROLLER-COATED  
55-GALLON  
STEEL DRUM**



**BIG CONTAINERS NOW "TRAVELING BILLBOARDS"**

Consider the merchandising opportunities this remarkable new package presents! The durable and lustrous finish of Rheemcote drums, lithographed with your distinctive colors, trademarks and designs, will billboard your product and name before the eyes of the world.



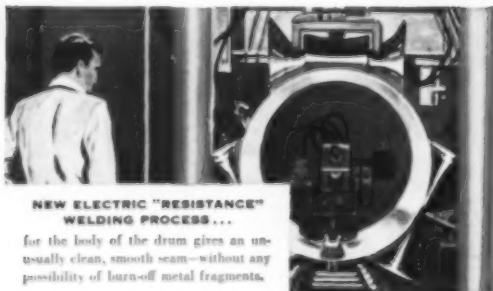
**SAFE AS A DRINKING GLASS**

For products which are hard to contain, or those requiring an absolutely clean interior—special lacquers are applied to the prepared interior surface, then cured in a temperature-controlled oven.



**ROLLER-COATING OPERATION...**

applies the base coat to the steel surface, assuring positive adhesion for utmost resistance against weather and handling.



**NEW ELECTRIC "RESISTANCE"  
WELDING PROCESS...**

for the body of the drum gives an unusually clean, smooth seam—without any possibility of burn-off metal fragments.

After many years of research, the Rheem Manufacturing Company, world's largest maker of steel shipping containers, is proud to have developed the Rheemcote Process in this, its 25th year of service to industry.

For a free, descriptive, beautifully illustrated brochure on this important contribution to marketing—write or wire Rheem today.



**RHEEM MANUFACTURING COMPANY**  
570 Lexington Avenue, New York 22, N. Y.  
Plants and Affiliates Throughout The World



*Relay on Rheem to Deliver Your Goods...and Goodwill*

IT ALWAYS PAYS TO SPECIFY

# LADISH

*Controlled Quality*

PIPE FITTINGS



TO MARK PROGRESS

## ...When you judge by Operating Statements

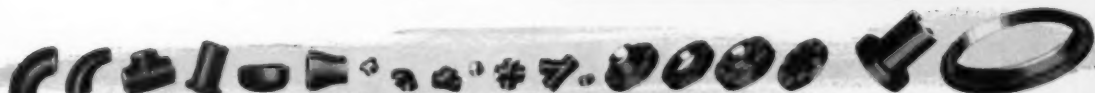
Maximum strength and endurance to minimize shutdown losses and replacement costs...these are important operating economies you can trace directly to the laboratory safeguards of Ladish Controlled Quality. Advanced metallurgical controls over materials and forging methods assure complete dependability in every Ladish fitting.

THE COMPLETE *Controlled Quality* FITTINGS LINE  
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

# LADISH CO.

CUDAHY, WISCONSIN  
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District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul  
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City





**THE SPEED REDUCER THAT  
SAVES YOU MONEY!**



**Dodge**

## **Torque-Arm**

**America's Most Complete Line of  
Shaft-Mounted Speed Reducers**

- No special engineering required. No foundation to provide. No flexible couplings. No sliding base. No "lining-up" difficulties. No expensive installation. Stock TAPER-LOCK sheaves prescribed for each job to provide desired speeds. Application to other machines is practical and easy.
- Unit is driven through any V-Belt Drive. Torque-arm, fastened to any fixed object, anchors the reducer unit. Turnbuckle provides fast and accurate adjustment of belt tension.
- Backstop available from stock when required. Simple. Positive. Easily installed. Sealed inside the reducer housing.
- Compact, light weight, rugged. Quality built by Dodge for Dodge dependable service.
- Built in two series—Single and Double Reduction. Capacities from 1 to 27 h. p. Speeds from 12 to 330 rpm. Available from distributors' stocks.
- WRITE for special bulletin A602.

DODGE MANUFACTURING CORPORATION, 200 Union Street, Mishawaka, Indiana

# **DODGE**

→ of Mishawaka, Ind.

CALL THE TRANSMISSIONER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in classified phone book.



V-BELTS AND TAPER-LOCK SHEAVES



DODGE THINNER PILLOW BLOCKS



ROLLING GRIP AND DIAMOND D CLUTCHES



SOLID STEEL CONVEYOR PULLEYS

**NAME PLATES**

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,  
CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO, ILLINOIS

# The Defense Production Problem

To win out in the struggle for freedom into which the Russian Communists have plunged us we must do at least four things. We must:

1. Speedily carry through a program of defense production which, at its peak, is scheduled to take about one-fifth of our national output.
2. Pay for this program as we go, by methods that will enable us to maintain the effort for an indefinite period — as long as may be necessary to insure peace and security.
3. Manage intelligently and endure intelligently a set of direct government controls which, in certain critical departments, will put our national economy for a time in a hateful straight jacket.
4. See that these emergency controls are not fastened upon us permanently thereby presenting to our Soviet antagonists a major victory for collectivism on our home front.

This is the first of a series of editorials designed to present in the simplest terms these key aspects of our struggle to preserve our free institutions.

## A Staggering Task

The magnitude of the defense production job staggers the imagination. Over the next year it calls for a larger volume of goods and services than the 20 million people of the states of New York and New Jersey will use for all purposes. The (London) TIMES has observed that, taken alone, the increase

of defense expenditures which has been budgeted for the federal government's coming fiscal year (about \$30 billion) "is in itself not far short of the total national income of the United Kingdom."

Yet so powerful is the production machine created by free American enterprise that, at the scheduled peak, the defense program will take only about one-fifth of our total national output. The exact form and dimensions of the program will, of course, be hammered out on the anvil of public and congressional debate. But the President's recent estimate of an annual rate of expenditure of \$45-55 billion for defense by the end of this year may well turn out to be somewhere near right.

To meet even these vast requirements of defense production we are in better shape technically than we were when we started to prepare for World War II. Our industrial plant and equipment is greatly improved. Over \$65 billion has been invested in it since V-J Day. Our working force is about eight million larger than it was ten years ago and much better trained.

The difficulty, and it is a very serious economic difficulty, is that we must fit the defense program into a productive machine that has been almost fully extended to meet the needs of a booming civilian demand. The present plan is to step up defense production during 1951 from about 7% to about 18% of our total national output. Because there is relatively little slack in our economy, this means that civilian production at the outset must

be cut back as defense production is stepped up.

The cut-back of civilian goods must be especially severe in the case of products made of metal. This is particularly true of goods that use scarce strategic metals such as aluminum and copper. Of our total defense production program, about half will go for "military hardware" — airplanes, guns, munitions, tanks and the machinery to make them. By the end of 1951 defense requirements are scheduled to absorb most of the metalworking production not required for essential construction and for the spare parts necessary to keep existing equipment running. For a time at least, there will be a sharp cut in the supply of new metal products available to civilian consumers. The defense squeeze on both materials and manpower will also cut sharply into housing and other civilian construction.

#### **For the Short Run — Controls**

In the short run there is no answer to the problem of meeting defense production schedules except controls. Sharp reduction of non-defense expenditures by government is essential and would help greatly. But the basic fact is that we cannot increase our total production fast enough to meet immediately both civilian and defense requirements.

Controls are needed, therefore, to switch resources from civilian to defense production, and at the same time prevent the combined demand for critical products from sending prices right through the roof. In the case of many scarce strategic metals such as nickel, copper and cobalt, the task of increasing output is especially difficult because our limited supplies are tucked away deep in the earth in many quarters of the globe.

For the longer pull — and that is what we must face — there is another answer to our defense production problem that is infinitely better than controls. And this time, in contrast to World War II, it is all-important that we get the right answer to our defense production problem for the longer pull and that we get it right now. In World War II we geared our economy to meet the requirements of a

relatively short and decisive conflict. Now our leaders, however they may differ as to methods, are well agreed that, at best, "the conditions under which we labor may persist for ten, fifteen or twenty years." That is General Bradley's phrase.

#### **For the Long Pull — More and Better Production**

For this longer pull, the constructive answer to our problem of defense production is clearly more and more efficient production all along the line. It is true that overall we now have the most efficient industrial establishment in the world. But, even so, much of it is far short of attainable efficiency. Some plants using up-to-date equipment and methods are as much as six times more efficient than others in the same industry that are lagging in modernization.

Our Director of Mobilization, Charles E. Wilson, has clearly in mind this problem of increasing our industrial efficiency. The first step in his job, as he conceives it, is to get out an adequate supply of weapons to equip the army, navy, and air forces already mobilized or in process of organization by us and our allies. The second step is to make sure of our capacity to produce both "military hardware" to meet any increased requirements and the maximum possible volume of goods for civilian use.

In concentrating on more and more efficient production, Mr. Wilson is squarely on the beam. We can attain his objective — by sustained effort on the part of each one of us backed by up-to-date industrial methods and equipment.

If we do that, we can maintain indefinitely an adequate defense effort and at the same time enjoy a standard of living higher than any other in the world.

Additional production and more efficient production are our surest safeguards against our two most menacing enemies on the home front — the deadly inflation that can destroy our free economy, and the strangling government controls that can destroy our political freedom.

*McGraw-Hill Publishing Company, Inc.*

# Want maximum tube life per dollar spent? Ask the experts!

Of all the high temperature tube steels made, only one can give you the best life/cost ratio. But how to select the *one right* steel from more than 20 analyses?

Get the help of the recognized authorities—the Timken Company metallurgists. Through 20 years of development and testing of 23 different analyses to solve specific problems of heat, pressure, corrosion and oxidation, they've gained the experience needed to choose the best steel for *your* job. And you're assured uniform, high quality steel in every tube because of complete, rigid controls—from melting to final tube inspection—practiced in our mills.

Let our "RSQ"—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, O. Cable address: "TIMROSCO".

This month we report on:

## 2% CR.-MO.

Has intermediate corrosion resistance in combination with good creep strength and fair resistance to oxidation. For use at temperatures up to 1200°F. in cracking coils, reforming units, heat exchangers, vapor line and hot oil piping, and return bend forgings for oil heaters.

### 23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3*
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20*
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12*
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

\*Available as seamless tubing on an experimental basis only.



20 years of extensive testing and research have made the Timken Company the leading authority on high temperature tubing. Photo shows Charpy impact tests.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



# TIMKEN

Fine Alloy

# STEEL

and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphite and standard fuel analyses—and alloy and stainless seamless steel tubing.

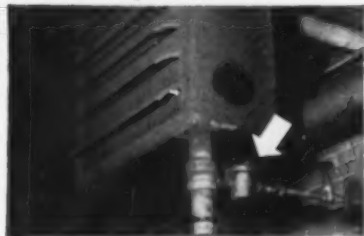
## A STEAM TRAP MECHANISM GOOD FOR 900°F, 950 PSIG

... will last a long time on low and medium pressures

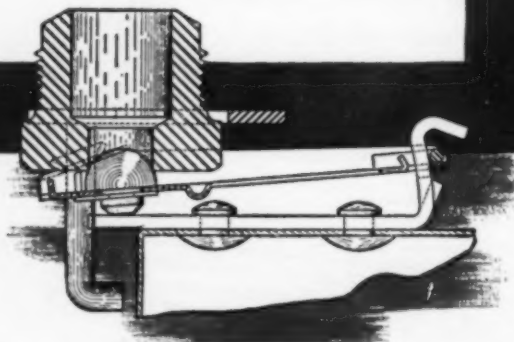
THESE ARMSTRONG  
USERS KNOW



"TRAPS OPERATE 4 TO 5 YEARS WITHOUT REPAIRS." . . . Weymouth Art Leather Co., South Braintree, Mass.



"50% LESS TRAP MAINTENANCE since installing Armstrongs on low pressure vacuum return heating system." . . . John Deere Ottawa Works, Ottawa, Iowa.



THE valve and seat in *every* Armstrong Inverted Bucket Steam Trap are chrome steel — hardened, ground and lapped to a steam-tight fit. The valve lever assembly and the bucket are corrosion resistant 18-8 stainless. You get the same design, workmanship and materials whether you order traps for a low pressure heating application or for a high pressure power plant application. *In other words, you get the longest-lasting, most trouble-free trap that money can buy at no premium in price.* If you think you'd like that, call your nearby Armstrong Representative for the traps you need now.

ARMSTRONG MACHINE WORKS  
858 Maple Street • Three Rivers, Michigan



FACTS, FIGURES, PRICES

and complete data on trap sizing are contained in the 36-page STEAM TRAP BOOK. Send for your copy.



# ARMSTRONG STEAM TRAPS



# UNIFORMITY

*Makes the Big Difference*

**in FILTER Fabrics**



**Gives You Greater Fabric Uniformity**



**The** greater uniformity of Mt. Vernon Extra means more efficient filtering — greater clarification of filtrates, more complete recovery of solids.

#### AT YOUR SERVICE

Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

*Mt. Vernon -*



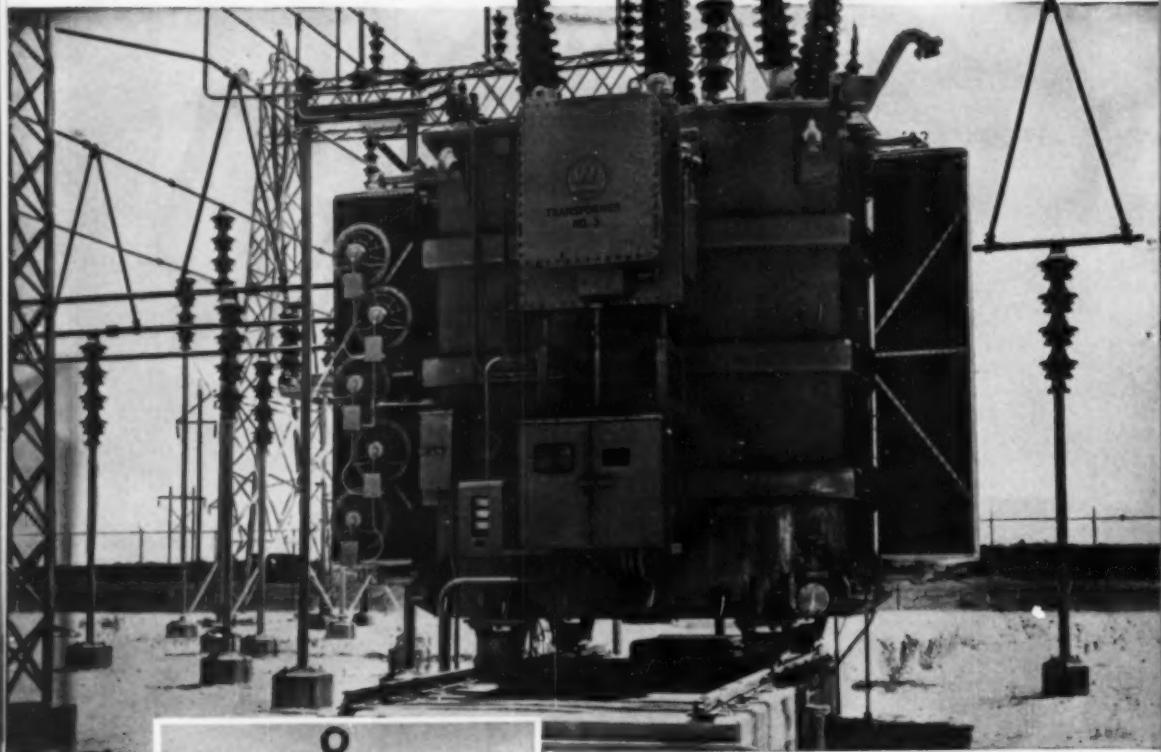
Branch Offices: Chicago • Atlanta • Baltimore  
Boston • Los Angeles • Akron



*Woodberry  
Mills*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



#### **This power transformer**

in a chemical plant is an example of the corrosion-resistant equipment designed by Westinghouse for the Chemical Industry. To resist weather and corrosive conditions, all transformer tanks are Bonderized. All-welded construction assures positive protection against leaks, moisture or corrosive fumes.

#### **The corrosion-resistance**

of the specially coated, heavy steel, Life-Line chemical motor is shown by the results of this extended salt spray test. Shown here are a cast-iron chemical motor (above) and the Life-Line chemical motor (below) after operating for several months in a 20% salt spray. At the end of this time, the Life-Line motor continued to operate while the cast-iron motor had failed. An examination of both motors showed considerably less corrosion on the Life-Line motor.

## We help you fight corrosion

# THREE WAYS

To help the Chemical Industry combat corrosion, Westinghouse has developed an extensive line of corrosion-resistant electrical equipment. We use three ways to make this equipment resist the corrosion that may exist in your chemical plant:

**Selecting Metals.** For each kind of equipment, we choose the metal or alloy suitable for the application that will best resist corrosion. For example, nonferrous alloys are used liberally in making Type E turbines, Type V outdoor disconnecting switches and Ignitron rectifiers. Specially coated, heavy gauge steel is used on our Life-Line chemical motors.

**Oil Immersion.** To give absolute protection against both corrosive and hazardous atmospheres, we make a wide variety of oil-immersed equipment. This includes oil-immersed power transformers, panelboards, circuit breakers, linestarters and pushbuttons.

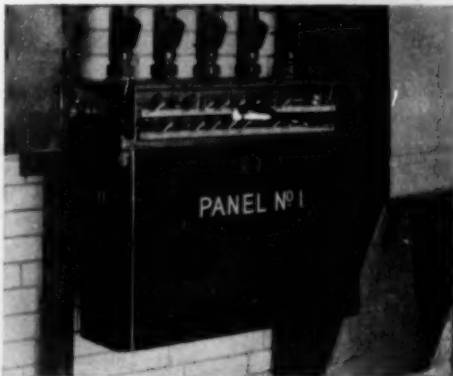
**Protective Coatings.** To prevent corrosion from creeping back under the paint film when a scratch occurs, we Bonderize the enclosures of Westinghouse switchgear, transformers and control equipment. To further protect our outdoor switchgear from corrosion, we also

give it an all-weather undersurface coating.

Westinghouse has Chemical Industry Specialists who will gladly help you with the solution of the electrical problems in your chemical plant.

Call your nearest Westinghouse District Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-94805



In this oil-immersed, nofuse "De-ion" breaker panelboard, each breaker is completely submerged in oil and operated by an external handle through a gland-type bushing. This provides a corrosion-resistant and explosion-proof panelboard.



## Westinghouse

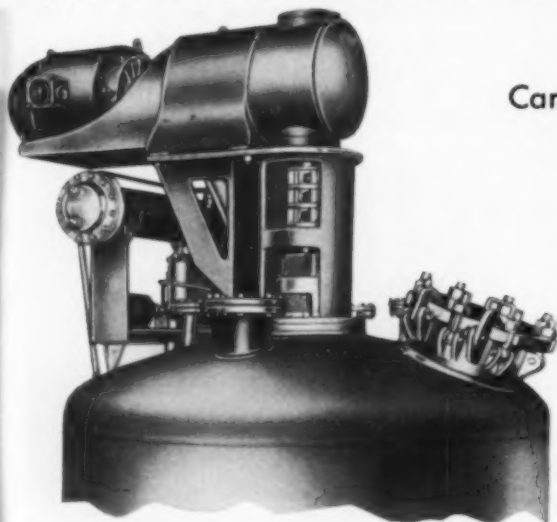
EQUIPMENT FOR THE  
CHEMICAL INDUSTRY

For Smooth Driving Action!

Easy Accessibility of Parts!

Long Trouble-Free Service!

# Struthers Wells Processing Vessels

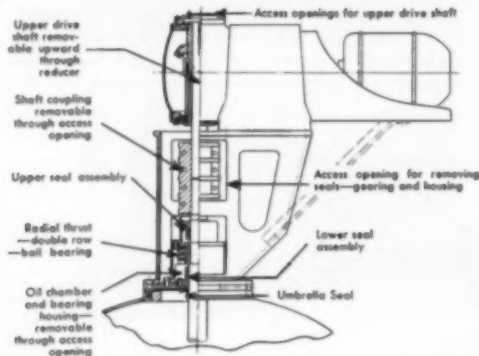


are equipped with  
Carefully Designed Agitator Drives  
for Extreme Temperature  
and Pressure Service

## NOTE THESE FEATURES . . .

- ★ All parts are accessible for quick and easy removal and replacement.
- ★ Agitator Drive Shaft is radially supported at top and bottom of the drive providing a spread of bearings practically equal to the vertical space occupied by the drive.
- ★ Agitator Drive Shaft thrust is taken by radial-thrust double row ball bearing located in close proximity to pressure seals insuring accurate centering and a minimum end-wise motion of the shaft at locations of seals.
- ★ Seal parts are carbon and non-corrosive metals to withstand corrosion in the same degree as the metal used in the vessel.
- ★ Oil circulating unit provides equalized liquid pressure seal, which also lubricates and cools the working parts.
- ★ An umbrella seal is provided to accumulate seepage of oil across the seal face and eliminate contamination of vessel content.
- ★ Standard units are available for full vacuum or pressures up to 500 psi. with processing temperatures up to 650° F.
- ★ Made in five sizes—ranging from 1 to 30 horsepower.

## Cross Sectional View Shows Accessibility of Parts



There is a dependable Struthers Wells Agitator Drive that will meet your exacting requirements. Write today for complete data on the size drive that will best suit your needs.



## STRUTHERS WELLS CORPORATION

Process Equipment Department . . . Warren, Pa.

PLANTS AT WARREN, PA. • TITUSVILLE, PA. OFFICES IN PRINCIPAL CITIES



## OPERATION: FLEXIBILITY

### A CLEAVER-BROOKS STEAM BOILER GIVES YOU:

- ✓ Quick, effortless response to fluctuating steam demands.
- ✓ Equally high efficiency (80%) operating with oil or gas.

Fluctuating steam loads are no problem when you have a custom-planned Cleaver-Brooks boiler in your plant. Whether your demand is heavy or light, steady or variable, these sturdy heavy-duty boilers respond instantly to your steam needs. Even with loads as low as 30% of rating, Cleaver-Brooks boilers operate with a flat 80% efficiency.

Cleaver-Brooks boilers burn either

oil or gas . . . either fuel is properly proportioned to meet your steam demand and need. No banking of fires or loss of valuable heat during low load periods. You benefit with lower fuel bills, less maintenance, reduced operating costs.

If you are considering a change in your present boiler plant—think about flexibility — and get the complete facts about Cleaver-Brooks custom-

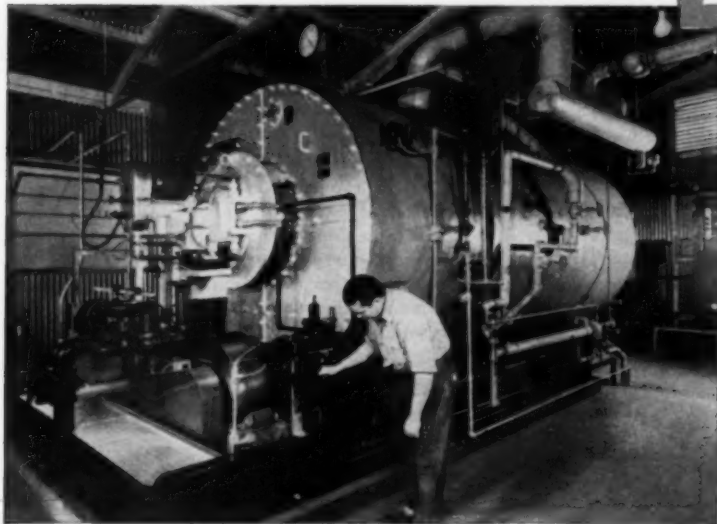
planned boilers. Cleaver-Brooks self-contained boilers 15 to 500 HP, 15 to 250 lbs., p. s. i. — oil, gas, combination oil and gas firing. CLEAVER-BROOKS COMPANY, 375 East Keefe Avenue, Milwaukee 12, Wisconsin.

#### **Cleaver-Brooks**

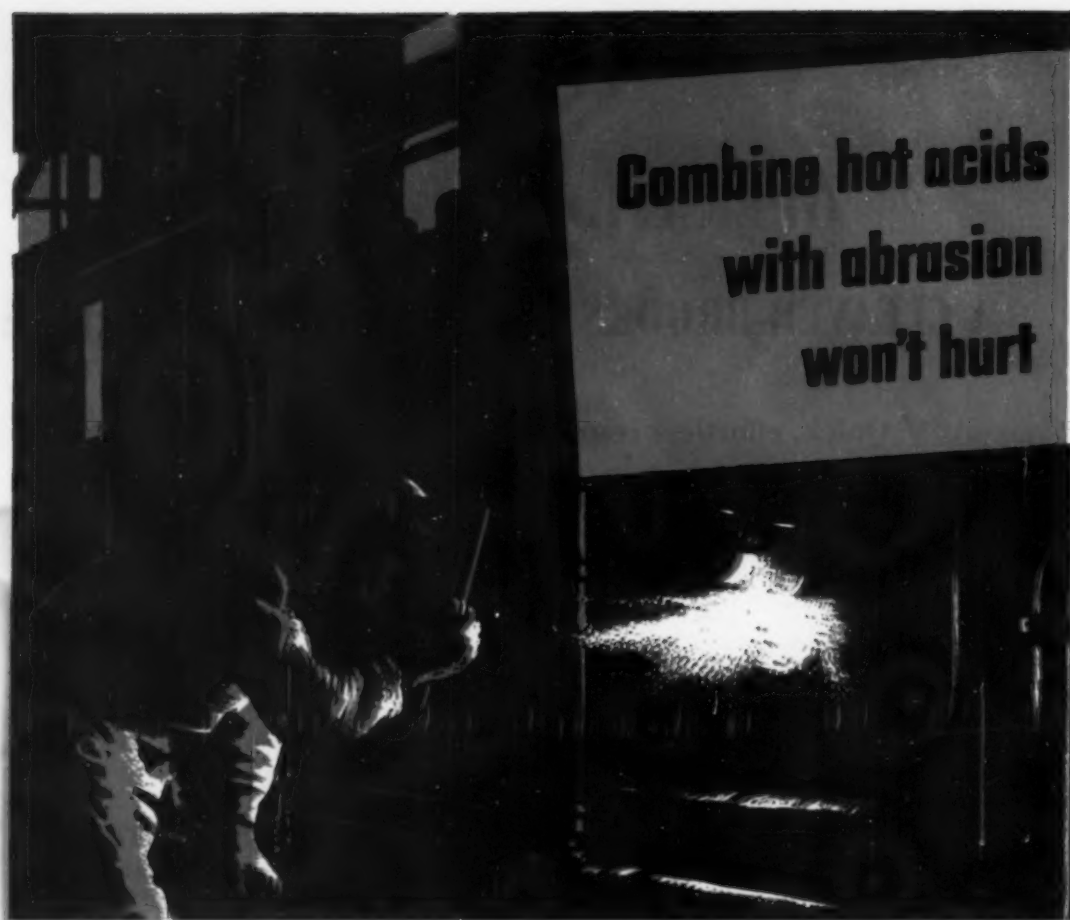
**STEAM BOILERS**  
*the first and finest of their class*



*Write for a  
Cleaver-Brooks  
Steam Boiler  
Catalog.*







Combine hot acids  
with abrasion  
won't hurt

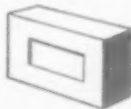
Among the various Super Refractories by CARBORUNDUM you will find several unique properties not usually associated with refractory materials. Amazingly high resistance to abrasion is one. Another is chemical stability — particularly in the presence of acids and acid fumes, and even at temperatures far above those that most metals will stand.

An example of an application where these characteristics are important is in ducts to and from  $\text{SO}_2$  converters. Here, high velocity  $\text{SO}_2$  and  $\text{SO}_3$  gases at  $1100^\circ\text{F}$  create very corrosive and erosive conditions. To counteract the chemical attack and the scouring action of these gases, linings made of CARBOFRAX silicon carbide material (one of the Super Refractories by CARBORUNDUM) are used in all vulnerable portions of the ducts.

A quite similar use for CARBOFRAX linings is found in muriatic acid furnaces, hydrogen cyanide converters,  $\text{SO}_2$  and  $\text{SO}_3$  recovery systems, sulphur burners and other related equipment.

Do any of these suggest possible applications? Bear in mind that immunity to acid attack and resistance to abrasion are only two properties of this one particular Super Refractory. As you can see in the box opposite, CARBOFRAX materials have many other interesting characteristics.

Information on *all the types* of Super Refractories by CARBORUNDUM is now available in booklet form. It outlines just what these unique materials can be made to do. May we send you a copy? No obligation, of course. Just use the coupon on the opposite page.



**or corrosive fumes  
and you still  
this material**

This advertisement — one of a series — is presented in the belief that in the unusual properties of the various Super Refractories by CARBORUNDUM lies the key to many new or improved processes. We would like to talk over specific jobs with anyone who sees such possibilities.

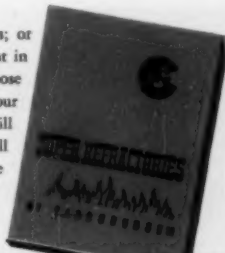
**Principal characteristics of  
CARBOFRAX Super Refractories**

- Outstanding abrasion resistance — at all temperatures from room to well above 2600°F. Successfully used to line coke and ore chutes and dust collectors. A good example of high temperature use is for skid rails in slab-heating furnaces.
- Far stronger, in all temperature ranges, than practically all other refractories.
- Very high thermal conductivity. Made-to-order for checkers, recuperator tubes and tile, muffles, hearths, linings for water-wall boilers, and similar applications.
- Low and uniform coefficient of expansion — .000005 per degree C between 25° and 1400°C. Spalling is rarely experienced.
- Readily withstand temperatures up to and often well above 3000°F. Excellent heat-shock resistance. Unaffected by temperature changes that will quickly ruin other refractories.
- Remain extremely hard at elevated temperatures, and therefore resist clinker or slag adhesions.
- Inert to acid attack.

CARBOFRAX refractories are available as brick and as special shapes molded to very close tolerances—including fitted joints, tubes, etc. They are not, however, a universal cure-all, and should be applied with caution where molten metallic oxides or molten bases are present. They will not withstand hydrofluoric acid. However, there are other Super Refractories by CARBORUNDUM that are applicable in these cases—particularly MULLFRAX electric furnace mullite, ALFRAX electrically fused alumina, and MONOFRAX fused cast refractories.

In our new booklet on Super Refractories, you'll find information about materials which, for example,

are highly resistant to erosion by molten glass; or make excellent insulators; or are unusually light in weight. The special qualities of these special-purpose refractories may go hand-in-glove with one of your processes. Why not check up? The coupon will bring you the story—or one of our engineers will be happy to talk over your specific problems. We believe it could be mutually profitable.



**THE CARBORUNDUM COMPANY**  
Refractories Division Perth Amboy, N. J.

"Carborundum," "Carbofrax," "Monofrax," "Mullfrax" and "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company

Dept. H-31

Refractories Div., The Carborundum Co.  
Perth Amboy, New Jersey

Please send your free booklet on properties of  
Super Refractories

Name \_\_\_\_\_

Position \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_

State \_\_\_\_\_

Let us  
help you solve your  
**SPEED REDUCER PROBLEMS**

Farrel speed reducers have incorporated in them the experience gained in the solving of innumerable problems requiring considerable pioneering in gear engineering. The result is a wide range of types (a few of which are illustrated here), that are standard in principal features, but adaptable in critical detail.

All units are supplied with precision gears, generated by the famous Farrel-Sykes process for smooth, quiet, efficient power transmission; shafts and bearings factored to safeguard against interruption of vital processes; gear cases proportioned to withstand repeated heavy peak loads; joints sealed to prevent entrance of dust and dirt.

But, that is not all. Without sacrificing the advantages of general standards, the design of these units permits an engineering freedom in proportioning gears, shafts, bearings and even some housing dimensions to meet specific load, speed and service requirements. This flexibility has resulted in the solution of innumerable application problems.

Write for further details. Ask for a copy of Bulletin 449—no cost or obligation.

**FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.**

Plants: Ansonia and Derby, Conn., Buffalo, N. Y., Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Cincinnati, Detroit, Chicago, Los Angeles, Tulsa, Houston, New Orleans

**Farrel-Birmingham®**

**Problem:**

A gear unit to transmit calculated load of 100 HP from a 125 HP, 1750 RPM motor to induced draft fan at 290 RPM, continuous 24-hour service.

**Solution:**

Equivalent HP =  $100 \times 1.50$  (service factor) = 150  
Ratio =  $1750 \div 290 = 6.03:1$   
Tabulated data in Bulletin No. 449 shows SR-137 unit to be correct size for this application.



SINGLE REDUCTION UNIT



SINGLE REDUCTION UNIT WITH PINION AND OUTBOARD BEARING



HEAVY DUTY REDUCTION UNIT

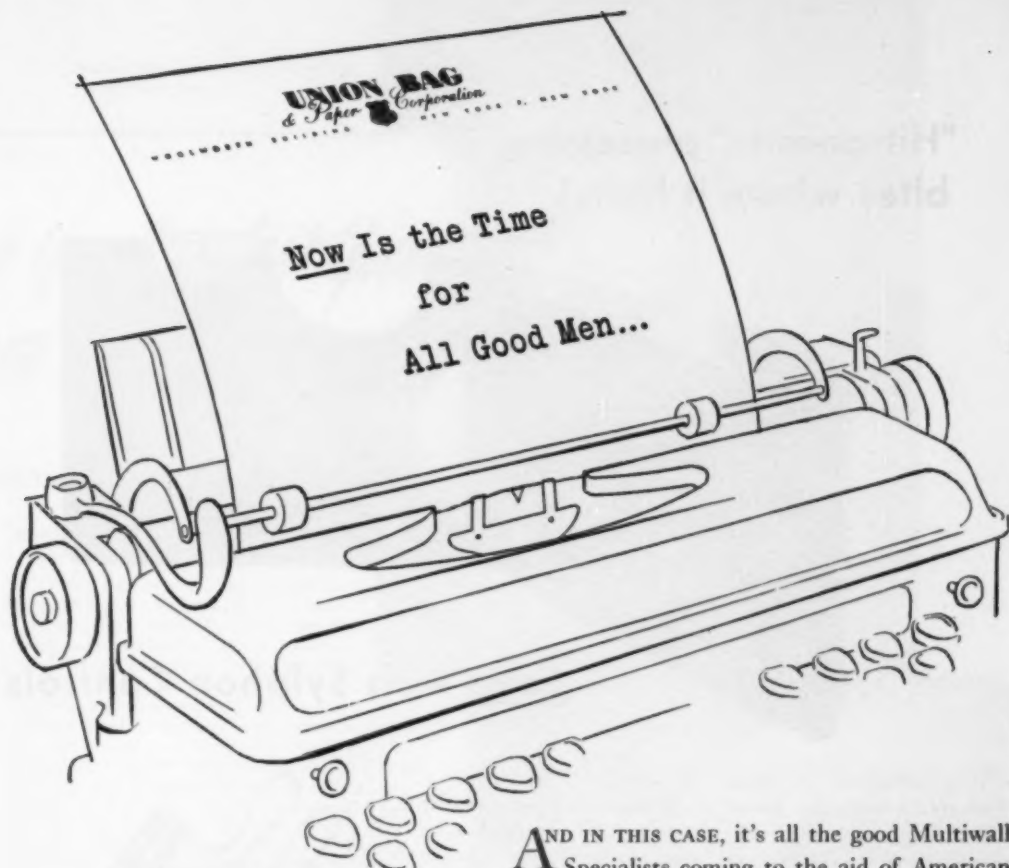


TWO SPEED RIGHT ANGLE UNIT



DOUBLE REDUCTION UNIT

FR-423



AND IN THIS CASE, it's all the good Multiwall Specialists coming to the aid of American manufacturers whose packaging problems are increasing with the national emergency.

Union's Multiwall Specialists are anxious to help, with whatever changes of material, or design may be required because of the nation's demands—which in these days come first, of course.

Let a Union Multiwall Specialist study your packaging problem. There is no obligation, and his recommendation may help you meet pressing needs faster, better.



Multiple Protection



Opens Easily



Prevents Siftage



Empties Clean

# UNION Multiwall Bags

UNION BAG & PAPER CORPORATION

233 BROADWAY, NEW YORK 7, NEW YORK



**"Hit-or-miss" processing  
bites where it hurts!**



## Save with Sylphon Controls

"GUESS METHODS" or hand-operated valves can never govern temperatures as efficiently or economically as Sylphon Controls.

Just see how Sylphon Controls can save for you! They operate automatically, maintain temperature that assures uniform processing conditions. Product quality stays constant. Spoilage and wasteful overheating are prevented. Man-hours, manpower and fuel

are saved.

Wherever temperatures must be held constant—hour after hour—day after day—you can depend on Sylphon Controls. Self-powered. Simple in construction and operation. Rugged, long-lasting—some have been in constant use for 30 years!

Find out how they can help improve your operations—save you money, too. Get full details by writing for Catalog EC-a.



*Sylphon Temperature Regulator 923—one of the complete Sylphon line. Available with dial indicating thermometer. Can be supplied with fu type bulb for controlling temperature of air or gases.*

**FS**

FIRST WITH BELLOWS

*Temperature Controls • Bellows Devices • Bellows Assemblies*

**FULTON SYLPHON**  
DIVISION

ROBERTSHAW FULTON CONTROLS CO. KNOXVILLE 4, TENN.

*Canadian Representatives, Darling Brothers, Montreal*



"Buffalo" Limit-Load Fan and Air Washer  
cleaning foundry air.

## How You Can Put Your AIR TO BEST USE

### "Buffalo" AIR CONDITIONING Can Do A Complete Processing Job

The industrial uses of air multiply daily! It's the recognized "comfort medium" that makes workers more efficient and productive. It's a "safety factor" which can minimize explosion dangers, fume poisoning and risk of "accident-prone" workers. It can control your product quality, your turnout—and your profits—to a remarkable degree! And present-day "Buffalo" Air Conditioning Units can create and maintain any air condition you require. You can wash your air, heat or cool it as desired, control the humidity exactly, collect dust by-products from your air—easily, continuously and economically—with "Buffalo" equipment.

### "Buffalo" FANS Often The Only "AIR CONDITIONING" You Need

Modern, efficient fans perform many of the functions of air conditioning. A "Buffalo" Limit-Load Fan, for instance, can "cool by ventilation"—circulating air continuously throughout the plant and causing a cool, comfortable feeling. "Buffalo" Fans can remove harmful dust, fumes and excessive moisture from your plant air. In these and dozens of other ways, "Buffalo" Fans can put your air to profitable use.

### IT COSTS YOU LESS THAN YOU'D THINK

"Buffalo" equipment is permanent equipment. Flimsy, lightweight "package" units are not part of our line. The results? Many "Buffalo" air washers are still giving efficient daily service over FORTY YEARS AFTER INSTALLATION. Many "Buffalo" Fans are OVER FIFTY YEARS OLD. Here, certainly, is long-run economy! Why not talk over YOUR air and its profit possibilities with a trained "Buffalo" engineer? Write us—we'll have him call on you AT NO OBLIGATION!

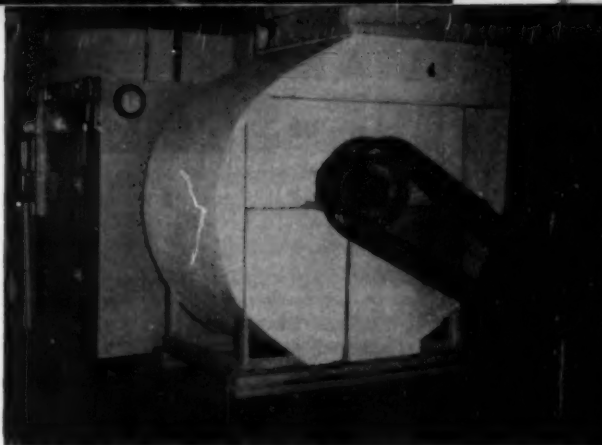
## BUFFALO FORGE COMPANY

501 Broadway

Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

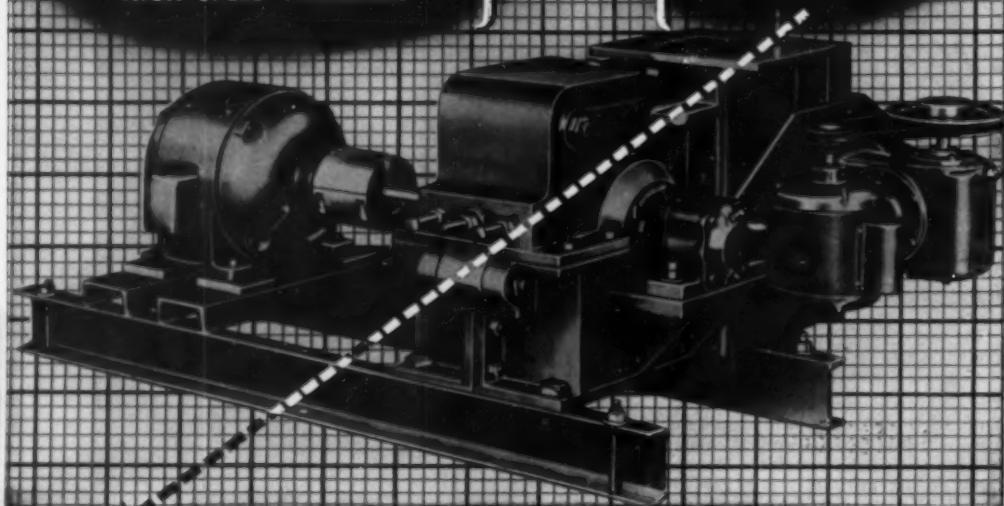


"Buffalo" "LL" Fan and Comfort Conditioning Cabinet supplying conditioned air in a large office building.

LONG GRINDING SURFACE  
ADJUSTABLE GRINDING PARTS  
HIGH SPEED HAMMERS



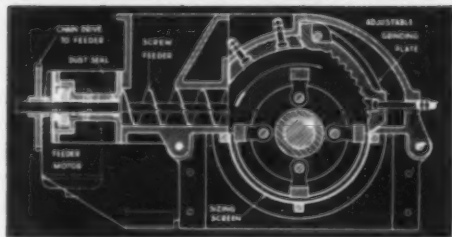
DUSTLESS  
FINE GRINDING  
(100 to 325 MESH)



## WILLIAMS HELIX-SEAL HAMMERMILL

**NO FANS, CYCLONES OR SEPARATORS.** Material fed into screw feeder is discharged at bottom of mill completely pulverized... with no oversizes or tailings to be separated. Screw feeder also acts as a seal against inrush of air. No dust! Williams' Helix Mill grinds many materials to 325 mesh. 100 to 200 mesh products are common on more difficult materials. Yes! It'll grind wet and sticky materials, too! Variable speed control permits grinding of different kinds of materials. **EASY, INEXPENSIVE TO INSTALL AND OPERATE!** Small floor space and lack of vibration calls for simplest of installation. Only requirement is a tight bin below mill with some sort of outlet. All parts are easily cleaned... on most materials simply by brushing. Feeder drive consists of roller chain drive from fractional horsepower gear head motor to feeder screws.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.  
3706 N. NINTH STREET ST. LOUIS 6, MO.



Sectional view of Helix-Seal Mill. Note long grinding plate against which the material is ground before it reaches the sizing screen. This plate is adjustable to compensate for wear.

### WILLIAMS ALSO MAKES...

Heavy-duty hammermills; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

# WILLIAMS

CRUSHERS GRINDERS SHREDDERS

# FISHER®

## V-RING PACKING

... LEADING THE  
MARCH TO BETTER  
DIAPHRAGM MOTOR  
VALVE PERFORMANCE

Improved by many months of field service,  
Fisher Teflon V-Ring Packing features:

- No gland leakage.
- Used on wide range of pressures without appreciable change in friction valve.
- Elimination of maintenance and adjustment.
- No valve stem lubricators required.
- Chemically inert to all fluids up to 450° F.

Fisher Teflon V-Ring Packing is now standard equipment on all Fisher Diaphragm Motor Valves.

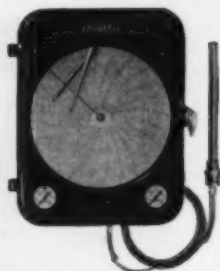
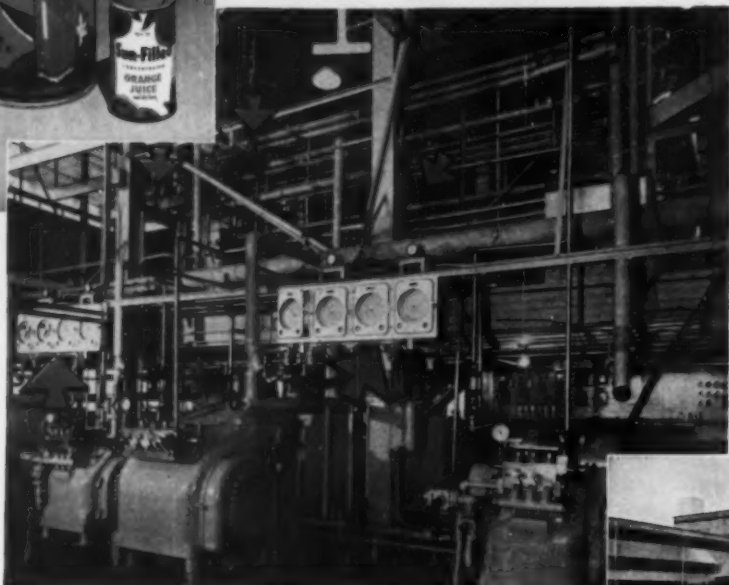
Bulletin E-200 gives complete details.

\*Teflon is the trade name of E. I. du Pont de Nemours & Co.

### FISHER GOVERNOR COMPANY



Illustration below shows 8 of the Powers Recording Regulators controlling eight diaphragm valves regulating temperature of orange juice concentrate being processed by SKINNER Mollorizer. At right: Powers Series 100 Recording Regulator.



Above: Powers No. 252 Pressure Indicating Regulator.

Powers Flowrite Control Valve

## Quality control

in JUICE INDUSTRIES (Div. of Clinton Foods, Inc.)

Increases soaring demand for their products

**POWERS**

Recording  
TEMPERATURE REGULATORS

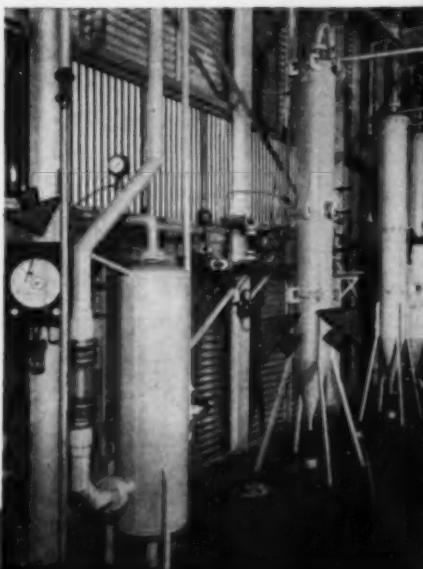
... controlling the SKINNER Mollorizer (above) and De-Oiler (at right) play their part in helping to maintain the uniformly fine flavor for which JUICE INDUSTRIES products are famous.

Whenever the quality of your products and your profits are affected by accurate, uniform temperature regulation ... consider POWERS. With almost 60 years experience and a wide variety of pneumatic and self-operated controls we may be able to help you select the best equipment for your requirements. If you have a problem of temperature or humidity control contact your nearest POWERS office or write—

(Enc. 5C)



Modern Plant at Dunedin, Florida



THE  
**POWERS REGULATOR CO.**

Over 55 Years of Pneumatic Temperature Control • Offices in Over 50 Cities • See Your Phone Book

CHICAGO 14, ILL. • Greenview Ave. • NEW YORK 17, N. Y. • 331 E. 44th St. • LOS ANGELES 5, CALIF. • 1804 W. 8th St. • TORONTO, CAN. • 170 Spadina Ave.



# Changing from batch to continuous processing boosted efficiency, saved valuable space

ANOTHER A.T. & M. SUCCESS STORY BY **Sam Spinner**



"RECOVERING SILVER NITRATE FROM PROCESS EFFLUENT IN THESE SETTLING TANKS IS SLOW AND COSTLY. SAM, WE NEED A FAST, CONTINUOUS, SMALL-SPACE PROCESS."

"HMMM... THAT'LL TAKE SOME DOING, BUT I'M SURE I CAN HELP YOU."

"I'VE MOUNTED AN A.T. & M. CENTRIFUGAL OVER A CONVEYOR BELT AND PIPED IN THE EFFLUENT. THE BASKET IS IMPERFORATE AND IS EQUIPPED WITH BAFFLES. THIS SETUP WILL HANDLE THE JOB AS A CONTINUOUS PROCESS."



"A CHEMICAL PRECIPITATES THE SILVER NITRATE AND AS THE BASKET SPINS, IT CAKES AGAINST THE BAFFLES WHILE THE LIQUID IS DECANTED OVER THE TOP. THE CAKE IS THEN PLOWED OUT THE BOTTOM ONTO THE MOVING CONVEYOR."



8 WEEKS LATER

"YOU'VE CURED OUR BIGGEST HEADACHE, SAM. CONTINUOUS CENTRIFUGING IS NOT ONLY MORE EFFICIENT, BUT I RECOVER MORE SILVER NITRATE AND SAVE THE VALUABLE FLOOR SPACE THOSE OLD SETTLING TANKS TOOK UP."

"YOU CAN'T BEAT CENTRIFUGING FOR LOTS OF PROCESSES. A.T. & M. CENTRIFUGALS ARE TAKING OVER MORE AND MORE CHEMICAL JOBS EVERY DAY... AND DOING 'EM FASTER, BETTER, AT LESS COST."



Let us bring you up to date on what modern centrifuging can do. **JUST MAIL COUPON. NO OBLIGATION.**

SAVE TIME, SPACE AND COSTS WITH

## A.T. and M. CENTRIFUGING

AMERICAN TOOL & MACHINE COMPANY  
1415 Hyde Park Ave., Boston 36, Mass.

Please send information on centrifuging applied to the following processes:

☐ Extraction ☐ Filtration ☐ Dehydration ☐ Coating ☐ Precipitation  
☐ Sedimentation ☐ Impregnation

Write here any other process .....

Name ..... Title .....

Company .....

Street .....

City ..... Zone ..... State .....

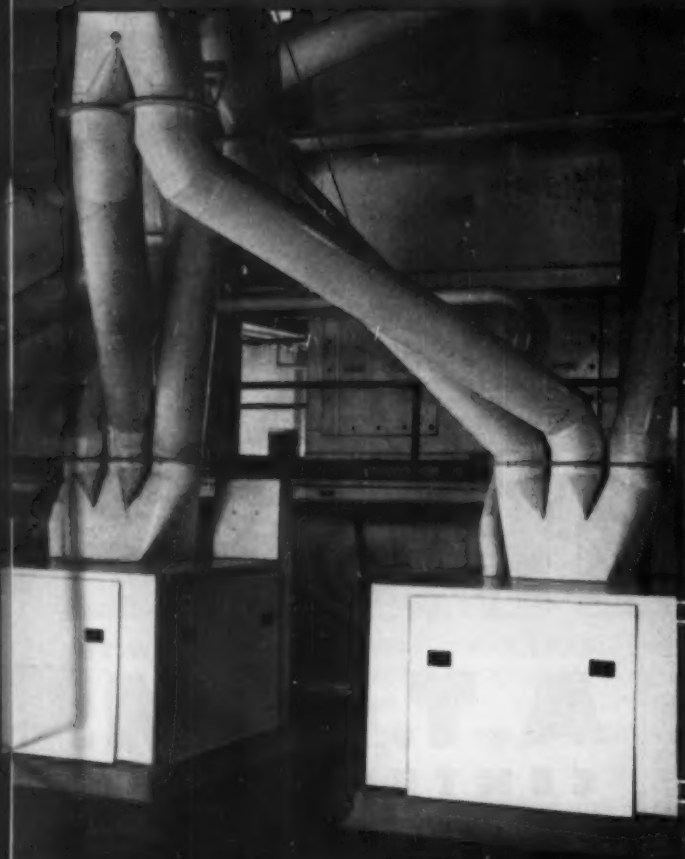




BROWN  
INSTRUMENTATION



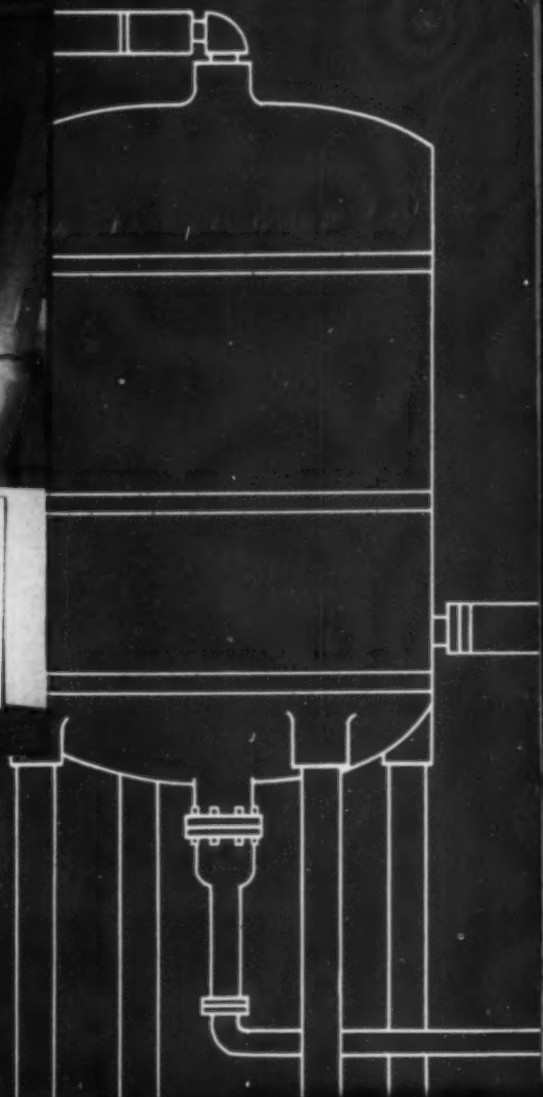
## THE MODERN



Continuous control panelboard,  
Joseph E. Spencer & Sons, Lawrenceburg, Indiana

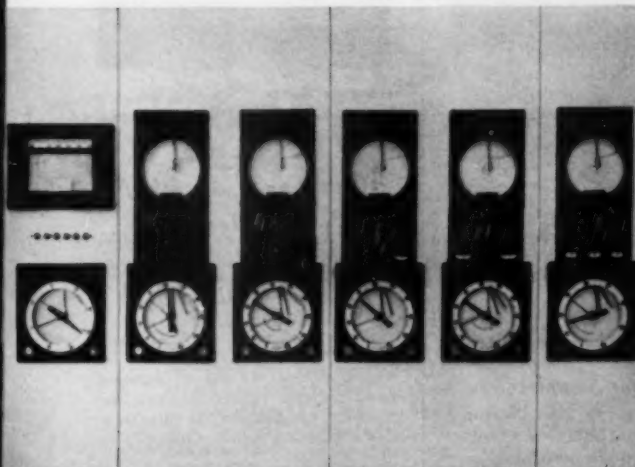
The intermediate bulk type grain scales (shown) are equipped with dual Grain Timer. Through this device and a series of intermounted instruments, the desired liquid flow to the penstock are automatically ratio controlled to the grain load.

This system is described in INSTRUMENTATION Magazine, Vol. 1, No. 2. Write for your free copy today.



# APPROACH TO

# Distillery Operations



## BROWN INSTRUMENTATION

... is patterned to the exact requirements of individual plants and processes.

... is the result of a practical and application know-how, with full responsibility from sensing elements to control valves.

... is backed by a nation-wide engineering and service organization.

ONE of the more recent developments in a modern distillery is the *continuous cooker*. Grain, water and stillage flow to the cooker in automatically ratioed quantities . . . temperatures, pressures and levels are also precisely controlled . . . and the entire operation is synchronized by Brown Instruments located on a central panelboard.

This continuous cooker marks another step forward in the trend toward continuous processing in distillery operation.

When looking for recording and controlling instruments for your distilling operations, or for any chemical process—consider first:

\* The Brown know-how developed through many years of application experience in the industry.

\* The completeness of the Brown modern approach—recorders, controllers, panelboards, valves, and all accessories.

Write for Instrumentation, Vol. 5, No. 2, for description of an automatic grain feeding system.

Call in our local engineering representative for a detailed discussion of your process requirements . . . he is as near as your phone. Offices in more than 80 principal cities of the United States, Canada and throughout the world. MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division, 4478 Wayne Ave., Philadelphia 44, Pa.

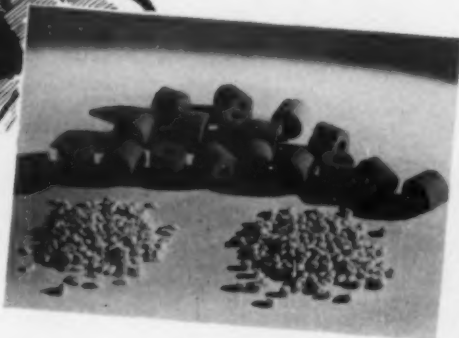
MINNEAPOLIS  
**Honeywell**

BROWN INSTRUMENTS



## Which catalyst supports are right for your reactions?

**NORTON ALUNDUM®** fused alumina catalyst supports are available in sphere, pellet and ring forms to give you the packing and bed characteristics you prefer.



**MANY COMBINATIONS OF PROPERTIES** are obtainable in Norton catalyst supports. Chances are that some of these combinations will meet your requirements. Look at the choice you get.

**ALUMINA CONTENT** — 77 to 89%

**WATER ABSORPTION** — 12 to 22% by weight

**SURFACE AREA** — 0.025 to 0.821 sq. meters per gram

**CRUSHING STRENGTH** — 20 to 600 pounds

**BULK DENSITY** — 60 to 80 pounds per cubic ft.

**SIZES AND SHAPES** — Spheres:  $\frac{1}{16}$ " to  $\frac{1}{2}$ " dia.; pellets:  $\frac{1}{16}$ " dia. x  $\frac{1}{8}$ " long to  $\frac{1}{4}$ " x  $\frac{1}{2}$ ";

rings:  $\frac{1}{16}$ " inside dia. x  $\frac{1}{4}$ " long x  $\frac{3}{16}$ " outside dia. to  $5\frac{1}{16}$ " x  $\frac{3}{4}$ " x  $\frac{3}{4}$ ".

### Write for Samples

It will pay you to give Norton Alundum catalyst supports a thorough test. It is quite probable they will give you more uniform reactions and better end-products. Remember, Norton has had 40 years' experience in controlling the chemical and physical properties of fused alumina products. Write for samples. Norton Company, 504 New Bond St., Worcester 6, Mass.

\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

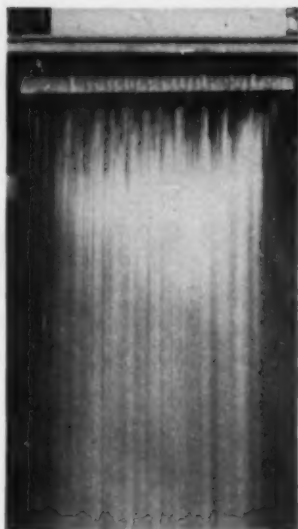


*Making better products to make other products better*

## Special REFRACTORIES

Canadian Representative

A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO



**FLOW OF WATER**, 1 foot head, through a Norton Alundum® porous plate of medium permeability.

## Can Fused Alumina Porous Mediums IMPROVE YOUR FILTRATION, TOO?

It's easy to find out. A complete analysis by Norton engineers and research men of the use of Alundum fused alumina porous mediums for filtration, aeration and gas diffusion is now available in bulletin form.

Write for  
Bulletin  
140



This 16-page bulletin gives you all the data you need to decide whether Alundum porous mediums will improve your laboratory and commercial processes at lower cost. Tables, charts and drawings give you the facts about the amazing chemical stability, uniform permeability, great strength, and easy installation of Norton Alundum porous mediums. Contact your nearby Norton representative, or write direct for Bulletin 140.

### NORTON COMPANY

504 NEW BOND STREET  
WORCESTER 6, MASS.

# COMPARE

## THIS FEATURE

### OF THE HONEYWELL

### SERIES "700" VALVE

\* Compare the Upper Stem Guide of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Specially Designed Diaphragm, the One-Piece Bonnet, the Packless Bellows Seal, the Safety Stem Lubricator, the wide variety of discs, the easy reversibility in the field.

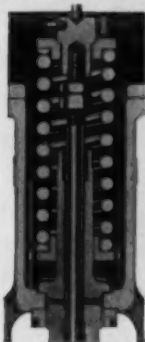
Your comparison will prove that the Honeywell Series 700 has all of the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Bulletin 700-3 or call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Industrial Division, 1904 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

New Bulletin 750,  
"Control Valve Sizing Data,"  
is now available

#### DUPLEX UPPER STEM GUIDE



Two bearings guide stainless steel upper valve stem. Top bearing is self-oiling; lower bearing is lubricated by an easily accessible grease cup. Continuous lubrication assures almost frictionless super structure responsive to slightest change in signal air pressure.



Specially Designed  
Neoprene Diaphragm

One-Piece  
Bonnet

Packless  
Bellows Seal

Safety Stem  
Lubricator

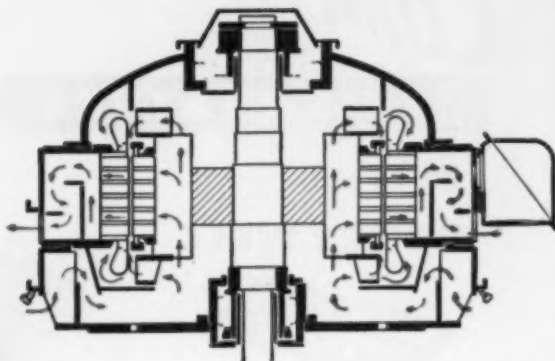
Wide Variety  
of Discs

Reversibility  
in the Field

# Honeywell

VALVE PRODUCTS

# Moisture gets

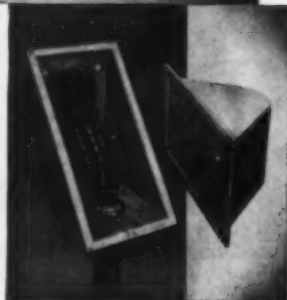


**VERTICAL  
TYPE**



## SPLASH-PROOF CONDUIT BOX

- Joint between box and frame gasketed and sealed.
- Cover joint gasketed and sealed.
- Conduit connection at bottom of box sealed during installation.



## Features of both motors

- Protected against wind-driven rain from all directions.
- Inlets and outlets so designed as to permit wind-driven foreign matter to blow entirely through and out without entering motor.
- Inlets and outlets baffled internally—air is taken into motor at low velocity.
- Screens or filters may be added to inlets.
- No objectionable air recirculation.
- Stator coils with mica wrapper on slot portion for 2300-volt and higher Class "A" insulation.
- Stator coils are vacuum-pressure impregnated.
- Stator and coils after winding given one complete dip and bake, and end turns two additional dips and bakes.
- All steel frame and brackets coated inside and out with rust-inhibiting finish.
- All mechanical joints sealed with gasket and/or a non-hardening sealing compound.

Built in sizes 150 hp 14 pole to 200 hp 4 pole  
300 hp to 1000 hp 2 pole



**ELLIOTT**  
RIDGWAY DIVISION

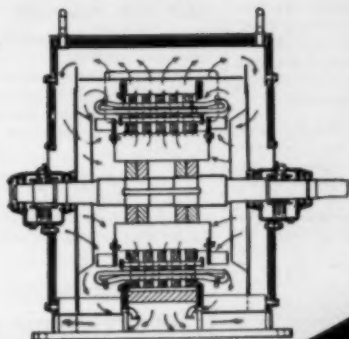
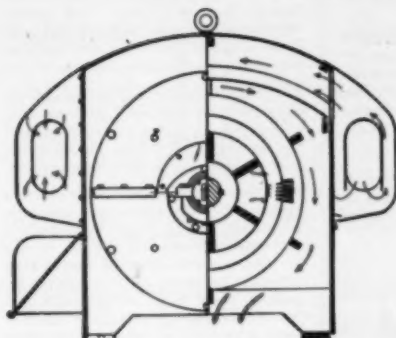
Plants at: JEANNETTE, PA.  
DISTRICT OFFICES

# IN MOTORS, IT'S ELLIOTT *all*



*the* **STOP** *sign in these...*

# **ELLIOTT** *outdoor* **SPLASH-PROOF MOTORS**



**HORIZONTAL  
TYPE**

## **In Vertical type**

- Normal mounting above driven unit well up from the ground, makes permissible air inlet at bottom of motor.
- Uniformly cooled—fan at bottom cools bottom half of motor—fan at top of rotor pulls air up through spider arms. Air discharges after passing through top end windings to cool top half of motor.

## **In Horizontal type**

- Requires only simple standard foundation or base—no special ducts nor cored openings needed.
- Seal split ring—oiled sleeve bearings, or anti-friction bearings.

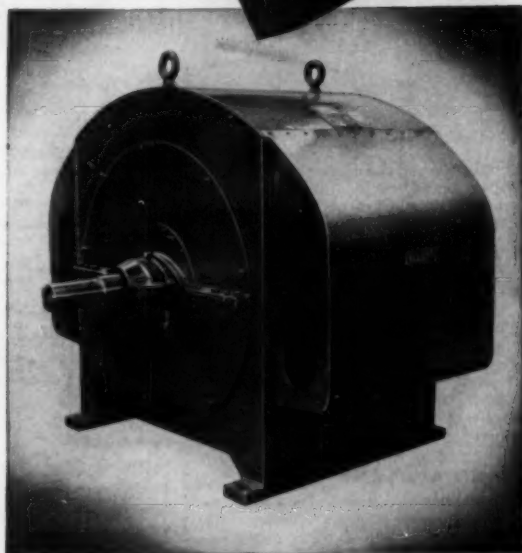
*For complete details contact your nearest Elliott Company District Office, or write us.*

# **C O M P A N Y**

**RIDGWAY, PA.**

RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

IN ALL PRINCIPAL CITIES



*the way from 1 hp up . . .*

**MONSANTO**  
CHEMICALS—PLASTICS

## FOR YOUR INFORMATION

Every month, Monsanto publishes these pages of pertinent information. Here you will find suggestions and applications ideas intended to help you improve your products, lower your production costs, increase your sales. More information will gladly be furnished on request.

## MONSANTO REPORTS to users of plasticizers

The needs of national defense, added to the extra requirements stemming from the rapidly growing popularity of plastics products, have created demands in excess of Monsanto's capacity to produce Santicizers and other quality plasticizers.

To meet the urgent needs of the present and the growing demand which we foresee in the future, we are expanding our capacity in both phthalate and phosphate plasticizers. We hope to be making deliveries from this increased production late in the current year or early in 1952.

### HELP FOR YOU NOW

Today, we offer our customers technical assistance based on the world's most extensive experience in plasticizers. In many instances we may be able to help you make the best possible use of any Santicizer\* or other plasticizers we are able to deliver.

For information on this technical service, which is offered to you without cost or obligation, contact the nearest Monsanto Sales Office or mail the coupon.



Monsanto can make immediate shipment of toluenesulfonic acid, technical, an intermediate and a catalyst in certain organic reactions.

The product is a viscous liquid or semi-crystalline solid with a greenish-to-black color. Its molecular weight is 172.20. It contains a minimum of 94.0% toluenesulfonic acid, a maximum of 1.0%  $\text{Na}_2\text{SO}_4$ , a maximum of 2.0% water and a maximum of 0.2% toluene. The Monsanto product is a mixture of approximately 80% para isomer and 20% ortho isomer. Toluene-sulfonic acid is available from Monsanto in 100-pound Mauer-type steel drums.

### ALSO AVAILABLE

In addition to toluenesulfonic acid, Monsanto can make immediate delivery of the following:

Monsanto Salt (Sodium ortho-chloro-para-toluenesulfonate)

## Toluenesulfonic acid, technical, available for immediate shipment

Ortho-Aminobiphenyl  
Ortho-Nitrobiphenyl

### OTHER MONSANTO INTERMEDIATES

Benzyl Chloride  
Benzoic Acid, Technical  
Cyclohexylamine  
Dicyclohexylamine  
Dinitroaniline  
Dinitrochlorobenzene  
Meta-Chloroaniline  
Meta-Nitrochlorobenzene  
Ortho-Nitrochloroaniline  
Ortho-Anisidine  
Ortho-Phenetidine  
Para-Anisidine  
Para-Phenetidine  
Para-Chloroaniline  
Salicylic Acid, Technical  
Thiourea

For further information, check your nearest Monsanto Sales Office.

## New product controls bacteria and algae in cooling water

A new, low-cost product, with proved effectiveness in controlling bacteria and algae in cooling water, has been added to the growing family of Monsanto Chemicals.

The product, Santophen® 45 (Sodium trichlorophenate, technical), has been used for two years in cooling towers with capacities up to 600,000 gallons, and the results have confirmed laboratory investigations.

Santophen 45 can be used alone or as an extender for such hard-to-get chemicals as chlorine, sodium hypochlorite, sodium pentachlorophenate and others. It may be used to fortify chlorine and sodium hypochlorite, being effective against organisms which these two chemicals cannot control. Santophen 45 is effective in water with a low pH, an advantage over many other water-treating chemicals.

The use of Santophen 45 saves the cost of frequent cleaning jobs, with the loss of service from towers that are shut down.

Test Santophen 45 and see how effective it is. We are sure you will find that it will deliver the results you want, and we can assure you of ample supply by the time you are ready to use it. To get your sample, mail the coupon or contact the nearest Monsanto Sales Office.

## New intermediates catalog is ready... send for copy



If you use intermediates, you will find Monsanto's new catalog interesting and worthy of a place in your files. The 12-page booklet contains technical information on more than 50 chemicals, many of which may be useful to you. For your copy of the catalog, which will be sent free and without obligating you, mail the coupon or contact the nearest Monsanto Sales Office.



Aroclor 1248 has been used as the heat-transfer medium in units like this for more than eight years.

## Aroclor 1248 is ideal nonflammable heat-transfer medium

Monsanto Aroclor\* 1248 (chlorinated biphenyl), in more than eight years' service, has proved itself to be an ideal nonflammable, liquid-phase heat-transfer medium. It is used continuously at temperatures up to 300° C., and at pressures of 30 pounds per square inch or less.

As a heat-transfer medium, Aroclor 1248 offers the following advantages:

*Freedom from fire hazard.*

*Viscosities to permit pumping at room temperatures.*

*Boiling point sufficiently above 300° C. to assure a liquid condition at all times.*

*Stability against heat, with enough safety factor to accommodate accidental overheating.*

*Freedom from corrosive action against valves, piping and other equipment made of iron, steel, stainless steel or bronze.*

*Simple construction of heating equipment.*

Aroclor 1248 is being used in both stationary and portable electric heaters with capacities around 40,000 B.t.u. an hour; and in gas heaters ranging up to 2,000,000 B.t.u. per hour.

If you have a job for a nonflammable, liquid-phase heat-transfer medium, consider Aroclor 1248. For details, contact the nearest Monsanto Sales Office or mail the coupon for Monsanto Technical Bulletin No. P-130.



In water, a sample of yarn may float for hours. Add Santomerse No. 1 and it is saturated rapidly . . . and sinks.

## Santomerse No. 1 . . . versatile product in cleaning and process operations

There's a good reason why Monsanto Santomerse\* No. 1 is called the all-purpose detergent and wetting agent. The reason: *versatility.*

Santomerse No. 1 is used effectively for cleaning, penetration, dispersion, emulsification and spreading. With such versatility, all-purpose Santomerse No. 1 is adding to efficiency in numerous operations in



Curds on the glass at the left were formed by soap in hard water. Santomerse No. 1 (right) prevents curds.

industry, agriculture and homemaking. Anionic Santomerse No. 1 has a minimum of 40% active alkyl aryl sulfonate, the remainder being principally sodium sulfate builder. This is the combination found best for high efficiency and economy.

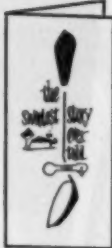
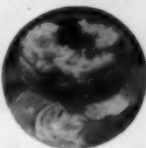
Santomerse No. 1 is effective in hard or soft water, in acid or alkaline baths, in hot or cold solutions. In operations where the pH is important, Santomerse No. 1 can be used because it does not affect the pH to any marked degree and any change that does take place can be adjusted easily.

If you use a detergent and wetting agent in your industrial processes, or if you compound cleaners for resale, look into the possibilities Santomerse No. 1 offers. Write for a copy of Monsanto's booklet, "Santomerse No. 1 All-purpose wetting agent and detergent," which gives much useful technical information.

\*\*\*\*\*Reg. U.S. Pat. Off.

MONSANTO CHEMICAL COMPANY, 1702-C South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, In Canada, Monsanto (Canada) Ltd., Montreal.

## Delicious dessert made without sugar



How would you like a recipe for this delicious, old-fashioned rice pudding? It's a sweet dish. And made without a grain of sugar! If you'd like the recipe . . . and nearly a score of others made with Monsanto Saccharin instead of sugar . . . get a copy of this booklet.

For your free copy of "the sweetest story ever told," mail the coupon.



SERVING INDUSTRY...WHICH SERVES MANKIND

### SEND INFORMATION:

☐ Plasticizer Technical Service.

### SEND LITERATURE:

- ☐ Bulletin P-130.  
☐ Intermediates catalog.  
☐ Booklet, Santomerse No. 1.  
☐ Booklet, "Sweetest Story Ever Told."

### SEND SAMPLE:

☐ Santophen 45.

MONSANTO CHEMICAL COMPANY  
 1702-C South Second Street, St. Louis 4, Missouri

Please send, without cost or obligation, material indicated at the left.

Name.....Title.....

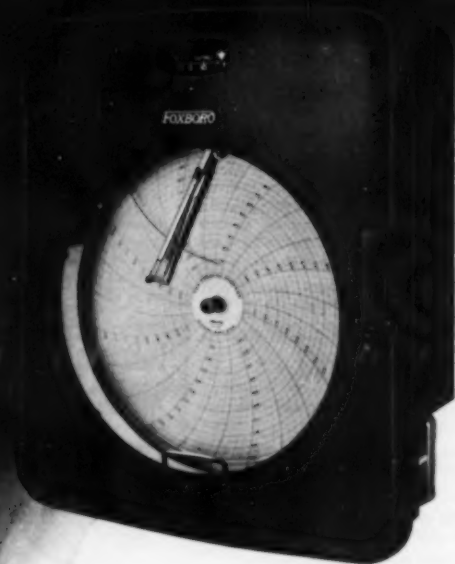
Company.....

Street.....

City.....Zone.....State.....

better measurement and control of

# FLOW



Wherever highest accuracy and complete reliability in flow measurement and control are vital to successful processing, it is significant that Foxboro Instrumentation is preferred. Whether your problem involves gas, steam, or liquids... in pipes, ducts, or open channels... the premium quality and complete diversity of Foxboro Instruments, backed by unequalled application experience, assure you an extra measure of satisfaction.

*indicators • recorders • controllers • integrators  
transmission systems • controlled valves • orifices  
venturis • nozzles • pilot tubes*

## FOXBORO

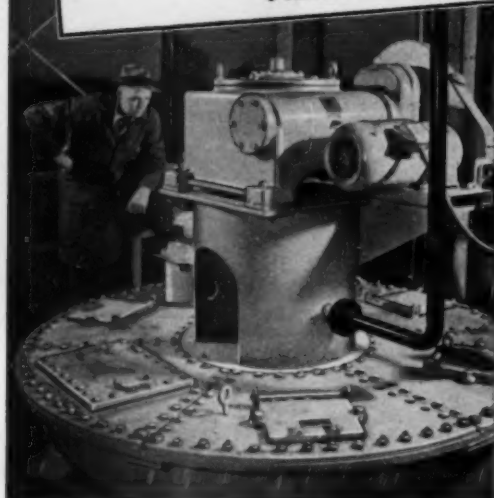
Reg. U. S. Pat. Off.

For over 40 years, specialists in the measurement and control of temperature, pressure, flow, liquid level, humidity . .

**THE FOXBORO COMPANY • FOXBORO, MASSACHUSETTS, U.S.A.**

# FROM TOP TO BOTTOM

ALLIS-CHALMERS GIVES YOU ...



## **MONEY-SAVING** Continuous Solvent Extraction Equipment

**T**ALK IT OVER with Allis-Chalmers. That's good policy for any firm planning new equipment for solvent extraction of vegetable oils.

When you buy an entire plant from A-C, you get the exact type and size of mill you want—designed to provide efficient, money-saving operation from top to bottom. And with the purchase of an entire plant you get individual process engineering plus correlated preparation, extraction, electrical, and pumping equipment.

If you are interested only in one or several pieces of machinery for your mill, A-C's wide line offers equipment for almost any solvent extraction need.

In cottonseed, soybean, corn germ, rice bran, and other products, Allis-Chalmers has pioneered in the production of solvent extraction equipment. Perhaps A-C can start your mill, too, on the road to greater profits. Mail handy coupon for complete information.

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Pioneers in the Field of Continuous Solvent Extraction

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MILWAUKEE, WIS.

- ☐ Please send solvent extraction bulletin 1386737A.  
☐ Am interested in information on solvent extraction of \_\_\_\_\_  
☐ Please send A-C representative.

Name \_\_\_\_\_

Title \_\_\_\_\_

Firm \_\_\_\_\_

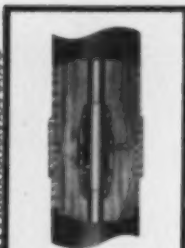
Address \_\_\_\_\_

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WHEN YOU LOOK  
TO TOMORROW . . . *today!*

Tomorrow's performance of the pumps you select *today* is an important first consideration! Will they be efficient for years . . . will they be easy and economical to service and maintain? These are the questions that should guide today's pump buyer.



Water lubricated, external sleeve bearing assemblies assure maximum life for bearing assemblies without sacrifice of line shaft streamlining or bow efficiencies.

In Fairbanks-Morse Pumps, you can be sure of these important advantages. Take the Fairbanks-Morse Pomona Vertical Deepwell Turbine Pump, for example. A new, water-lubricated external sleeve bearing assembly assures longer life wearing surfaces . . . minimum friction and shaft bearing losses . . . simple, easy replacement of worn sleeves.

This new feature and the many other Pomona advantages are your assurance that the pump you buy today will be efficient and economical tomorrow . . . and for years to come.

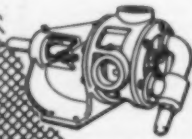
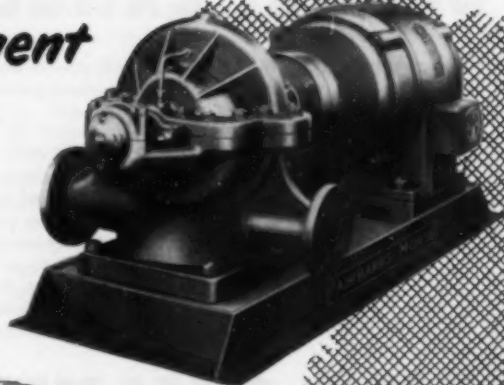


# FAIRBANKS

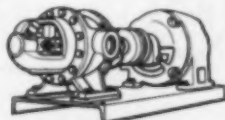
## A NAME WORTH

### AND, FOR ANY *Pumping Requirement*

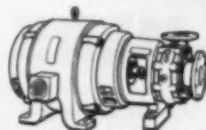
. . . you'll find a dependable, efficient Fairbanks-Morse Pump that will give you a new conception of low-cost pumping. Whether you need a centrifugal . . . a rotary . . . sewage or trash pump . . . turbine . . . vertical or horizontal angle-flow, you'll find the size and capacity you want in the Fairbanks-Morse line. This completeness of line is an important advantage to you . . . you can simplify your ordering . . . your parts and service . . . your inventory by standardizing on a single source, Fairbanks-Morse.



Rotary pumps



Westco Turbine pumps



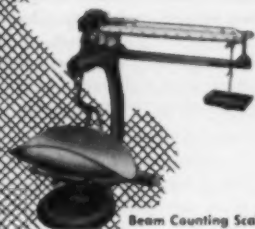
Built-together centrifugal pumps

Horizontally split case centrifugal pump

## YOU CAN *Count* ON THIS SCALE . . .

You can count small parts or pieces, with Fairbanks-Morse Counting Scales easily and accurately *by weight!* They save time . . . save money . . . eliminate errors. Whether you manufacture or buy small parts in quantity, these accurate counting scales are one of your biggest aids in inventory control, in estimating cost work and in determining the volume of piecework.

With the *exact* counts you get, you eliminate the possible loss of customer good will over "short count" shipments . . . assure better labor relations through accurate piecework records and less fatiguing inventory work. You'll find it pays to "count on" a Fairbanks-Morse Counting Scale.



Beam Counting Scale



Dial Counting Scale

# MORSE

## REMEMBERING

### AND, TO SPEED AND SIMPLIFY *Industrial Weighing*

. . . you'll find the complete line of Fairbanks-Morse Scales your best answer. These accurate weighing instruments make reading easy . . . minimize the chance for human error. Designed for sustained accuracy, these dependable weighing instruments cut the costly little weighing errors that can mount up to so much lost profit. Your Fairbanks-Morse weighing expert will be happy to check your weighing operations with an eye to elimination of costly errors and faster weighing operations.



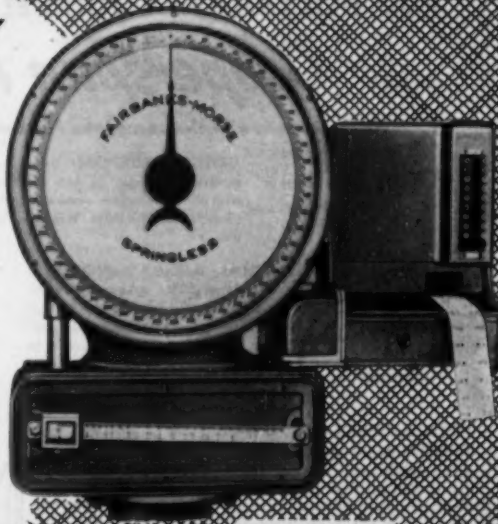
Full Capacity Beam Scale



Bench Dial Scale



Portable Dial scale



Printomatic Dial Scale

..YOU WANT THIS ROTOR DESIGN...

*It's Copperspun!*



If you buy or use motors, chances are that most of them are of the polyphase squirrel cage type—the most widely used class of integral horsepower motors made—for sustained heavy-duty drives in almost every class of service.

In rotor design, such service separates the good from the poor—and highlights your need for Fairbanks-Morse motors with Copperspun rotors, made through an exclusive centrifugal casting procedure developed by Fairbanks-Morse.

For in Copperspun rotors, you get the benefits of superior electrical characteristics—plus a design that is mechanically stronger for withstanding the most severe working conditions.

# FAIRBANKS

## A NAME WORTH

FOR POLYPHASE SQUIRREL-CAGE MOTORS

with *Copperspun Rotors!*

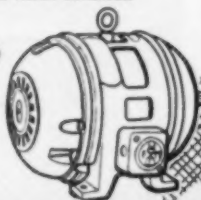
Here are a few in the complete Fairbanks-Morse line

**GENERAL PURPOSE**, drip-proof motors mountable in any position with full protection against flying chips, falling particles, dripping liquids, etc.

**AXIAL AIR-GAP MOTORS:**

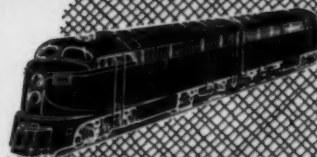
Averaging 30% lighter and 40% shorter overall—with flywheel effect three times that of corresponding ratings of conventional motors. Add to appearance, decrease size and weight of any driven machine. Meet all AIEE and NEMA standards.

**TOTALLY ENCLOSED FAN-COOLED** motors operate economically, safely under adverse conditions, including corrosive gas, vapors, steam or where metallic particles, abrasive dust and/or other materials are in the air. Available with Underwriters labels for use in Class 2, Group C hazardous locations.



## Why Our Best Customer is Hard to Satisfy

Perhaps the "best customer" for Fairbanks-Morse products is Fairbanks-Morse itself—for all Fairbanks-Morse products are components of and/or used in the manufacture of all other Fairbanks-Morse products. Fairbanks-Morse diesel locomotives, for instance, prove up the design advantages of Fairbanks-Morse Opposed-Piston diesel engines, electrical equipment and pumps—all of which have broad preference in many separate and specific industries. Fairbanks-Morse pumps are driven by Fairbanks-Morse motors . . . Fairbanks-Morse raw materials are weighed through manufacture by Fairbanks-Morse scales . . . a continuing close interrelationship between research, design, manufacture and use that results in products that are designed and built from your standpoint . . . that assures your good judgment in buying from Fairbanks, Morse & Co., Chicago 5, Ill.



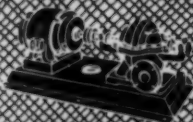
**Diesel Locomotives:** For yard, switcher, transfer, suburban, freight and high-speed passenger service.



**Diesel Engines:** For all stationary and marine service including dual fuel applications.



**Scales:** For every weighing operation, including truck scales, railroad tank scales, dial, beam, belt, conveyor, counting and platform scales.



**Pumps:** Vertical, deep well, centrifugal and rotary pumps of all sizes, also specialized pumps for the widest range of applications.



**Home Equipment:** Lighting plants, home water systems, water softeners, lawnmowers, etc.



**Electric Motors:** Complete range of size and types to meet your individual requirements. Direct motor distribution.

# MORSE

## REMEMBERING



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Amhurst 7701

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659 E. 25th St.  
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**BIRMINGHAM 1, ALA.**  
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36546

**BOSTON 10, MASS.**  
178 Atlantic Avenue  
LA3-3600

**BUFFALO 3, N. Y.**  
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Lin. 4210

**CHARLOTTE 2, N. C.**  
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Room 605  
62893

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**DALLAS 2, TEXAS**  
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**HOUSTON 13, TEXAS**  
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Franklin 3684

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**TULSA 3, OKLA.**  
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38231

**WASHINGTON 5, D. C.**  
1000 Vermont Ave., N. W.  
District 6894

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## STOPS CORROSION

It's worth checking into — one of the many Tygon Plastic formulations may be the answer to your tough corrosion problems.



**LIQUID TYGON**  
quickly applied coating, as protection against corrosive fumes.



**EXTRUDED TYGON**  
Tubing, channel, special shapes, solid cord.

**MOLDED TYGON**  
Gaskets, grommets, diaphragms, molded mechanical items.

This dense, impermeable, 3/32" thick press-polished Tygon Sheet plastic shrugs off corrosives that quickly destroy rubber and other lining materials.

Tygon-lined equipment will handle safely all reducing acids as well as such highly oxidizing acids as chromic, hydrofluoric, nitric and sulphuric. Tygon is completely unaffected by oxidation.

Tygon sheet plastic wears well. Its tough sturdiness resists abrasion; it is easily repaired if accidentally gouged or damaged; its mirror-smooth surface stays clean longer.

The next time you're faced with one of those "tough" lining jobs, talk to our engineers about Tygon. The U. S. Stoneware Co., Tallmadge square, Akron 9, Ohio.

MANUFACTURERS AND FABRICATORS OF CORROSION RESISTANT MATERIALS AND EQUIPMENT SINCE 1865



# THE Chemementator

Reg. U. S. Pat. Off.

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

## Wonder metal now a rookie

Purchase of 75,000 lb. of titanium metal products from Titanium Metals Corp. of America has been arranged by Army Ordnance. At current prices, this will cost about \$1 million. D.O. numbers will speed delivery of the products made from the new metal.

Titanium Metals Corp. of America is jointly owned by National Lead and Allegheny Ludlum. National Lead produces the sponge titanium metal; Allegheny Ludlum processes and fabricates it. Titanium and titanium-based alloys are being produced for use in experimental ordnance equipment.

Production of titanium metal in the United States in 1950 has been estimated at 100,000 to 120,000 lb.

## Mining AEC for new techniques

After ransacking the AEC's classified patents and exploring electromagnetic separation processes in the Y-12 plant at Oak Ridge, a working party of engineers and technical editors reports that the AEC's declassification program is progressing satisfactorily. The party has uncovered certain new techniques important to industry.

The whole technique of electromagnetic separation, it finds, is new and will have great impact on the chemical industry. Chemical engineers will want to know about these other important advances in technology that the group turned up: (1) methods of separating rare earths; (2) ion exchange of the rare earths; (3) use of oxygen to supplement an air feed to an incinerator unit; (4) vacuum technology; (5) certain control techniques; and (6) safety measures.

## TVA reverses its field

A few months ago TVA had just about decided to get out of concentrated superphosphate production. Prime purpose was to discontinue manufacture by processes that were fairly completely developed and needed no further demonstration. Hence the plan contemplated stopping production of normal and concentrated superphosphate. The idea was to bear down on other new processes.

Outbreak of war in Korea and the impact of the national defense program made TVA suddenly reverse its field. Now TVA intends to keep on turning out elemental phosphorus for the military and to make as much concentrated superphosphate as it can with remaining facilities, in order to help meet the shortage of this fertilizer.

Perhaps even more significant than this shift in policy on concentrated superphosphate is a plan to uncork a brand new development. It's stated that TVA has come up with a process using nitric acid, ammonia and some phosphoric or sulphuric acid to produce a novel high-analysis fertilizer. A plant with an annual capacity of 40,000 tons was to have been built soon; but this project has been abandoned temporarily because of changes in national policy and budget restrictions on non-defense construction.

## Scramble for sulphuric

The fertilizer industry is up in arms over diversion of sulphuric acid to other uses. One triple superphosphate plant in Idaho, that of Gates Bros. at Wendell, has already shut down completely because it couldn't get sulphuric acid. The acid situation is tight in southern California and the Mountain States. Some acid from the Tacoma, Wash., smelter of American Smelting & Refining Co. has been going into the Mountain States.

Informally, NPA is helping out users. They're coming to the agency from the steel, petroleum and mineral industries. NPA's Chemical Division is reported giving almost daily service to users in finding acid. This means phone calls to producers, urging them to give small quantities to manufacturers and processors to tide them over until things improve.

Off the record, NPA officials feel control action is needed and may be forthcoming. The Chemical Division is pushing the move for controls.

## RFC loans for synthetic fuel plants?

The government may finance construction of synthetic liquid fuel plants and purchase their products. Two bills, S. 6 and H. R. 1316, have been introduced in Congress. Washington fears the U. S. won't have enough petroleum to fight another global war.

Both bills call for RFC loans, for up to 30 years, to finance building of the plants. RFC would buy the output of the plants, even at a loss. The Interior Department would help on the technical and economic angles of the operations.

The bills provide that, if private industry doesn't build the plants either with its own money or RFC loans, the government can build and operate them.

Under the Senate measure, RFC is to have no more than \$650 million outstanding at any one time

(Continued on page 72)

## **THE CHEMENTATOR, continued**

for loans; under the House bill, the ceiling is \$350 million. Both call for a \$1 million appropriation to Interior for its part of the work.

A third bill, H. R. 279, provides for production and stockpiling of synthetic liquid fuels. Under this measure, RFC could build and operate under lease plants to make gasoline and oil from coal. Interior Department would be the technical advisor. After enough gasoline and oil were stockpiled for military purposes, the plants could be put in standby or disposed of as surplus.

The Interior Department is pressing for a synthetic plant program. The anticipated widening gulf between U. S. demand and supply ultimately will have to be met by synthetic liquid fuels and imports, says W. C. Schroeder, chief of the Synthetic Liquid Fuels Branch in the Bureau of Mines. "Of the two," he declares, "only synthetics can offer an assured supply from known resources within our own borders, a supply that is not subject to vulnerable sea lanes, foreign expropriation, or exorbitant taxes and concession fees."

Bureau engineers have succeeded in getting gasoline and oil costs down to 15 c. a gal. from coal and 8 c. a gal. from oil shale. The costs average even less when credit for chemicals and other byproducts is made.

The fact that benzene, toluene and other chemicals now in short supply can be obtained during the hydrogenation of coal, for example, will loom large to many congressmen and may result in favorable action on the bills.

Meanwhile, the country's first commercial synthetic fuels plant, built at Brownsville, Tex., by Carthage Hydrocol, soon should be producing gasoline and other liquid fuels from natural gas.

### **Natural gas from Alberta**

Within the next few months the United States may get natural gas from Alberta. The provincial government of Alberta has banned export of gas until further reserves can be found. But U. S. officials, acting for Defense Mobilization Director Charles E. Wilson, have warned the Canadian federal government that the U. S. needs the Alberta gas to develop its own Northwest and for the defense of the continent. According to Premier Manning, this can change the situation.

Meantime, Canada's Board of Transport Commissioners in Ottawa has adjourned hearings of applications by Westcoast Transmission Co., Alberta Natural Gas Co., Ltd., and Prairie Transmission Lines until April 5. By then, President Frank McMahon of Westcoast hopes his company will have discovered enough wells in northern Alberta to get the provincial ban lifted, clearing the way for final board action in Ottawa.

In the Ottawa hearings, the Transport Board is getting ready to streamline action on the route applica-

tions by limiting each company to two routes. The chief effect is that Alberta Natural Gas will have to cut its four proposed routes to two.

In Alberta itself, the provincial government has acted to speed up exploration by issuing new regulations covering the licensing of "gas only" rights on large blocks of Crown lands. The regulations provide lowered fees on large blocks up to 100,000 acres. The six-month licenses, renewable to a maximum of three years, can be held only by drilling for gas. Even areas where oil has been struck can be explored again for gas zones not vital to the production of petroleum.

### **Canada: new petrochemical frontier**

**BOOM IN ORGANICS**—A new petrochemical empire is aborning up in Canada. It's based on natural gas from Alberta's booming oil fields. At Edmonton, Celanese will build a big plant to make from this gas a whole raft of basic organic chemicals never before produced in Canada. They're vital to the defense of Canada and the U. S. in wartime, and they mean a long step toward industrial self-sufficiency for the Dominion in peacetime.

**ACETIC PLUS PULP**—Acetic acid made in the new plant will be combined with wood pulp from the Prince Rupert, B. C., plant of Celanese to produce cellulose acetate.

**OTHER PRODUCTS**—In addition to turning out acetic acid, acetic anhydride, acetaldehyde and acetone in volume, the Edmonton plant will make formaldehyde, methanol, propylene glycol, and other alcohols and solvents.

**PROCESS**—Hydrocarbons from the natural gas will be oxidized directly. Celanese pioneered this process, and has been producing chemicals by it since 1945 at its Bishop, Tex., plant.

**TIMETABLE**—The new plant at Edmonton, to be built and run by the Canadian Chemical Co., Ltd., a Celanese affiliate, won't be completed for more than a year.

**SIGNIFICANCE**—Advent of this petrochemical enterprise is one of the most significant events in Alberta since oil was struck in the Leduc field in 1947. It gives Alberta's petroleum-primed boom an added impetus.

### **New petroleum benzene producer**

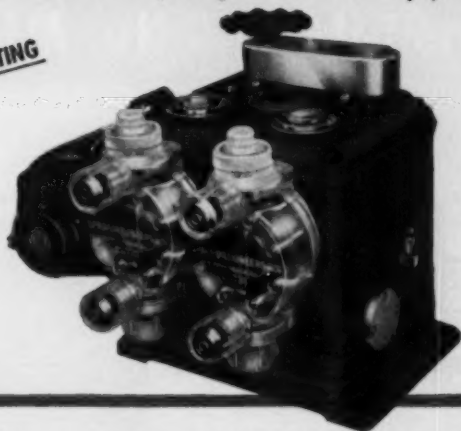
The benzene-hungry chemical industry, unable to get enough from byproduct coke ovens, turns increasingly to petroleum refineries as another source. Standard Oil Co. of California will build at its El Segundo refinery, near Los Angeles, a plant to synthesize benzene from petroleum. To cost over \$10 million, it will use the Platforming process of Universal Oil Products.

When completed in mid-1952, the plant will produce 13 million gallons a year. That's about 15

(Continued on page 76)

# CONSTAFLO

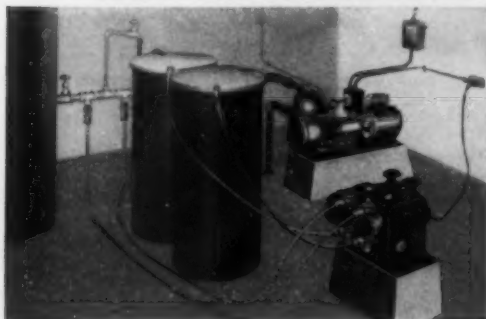
a NEW all purpose chemical proportioning pump



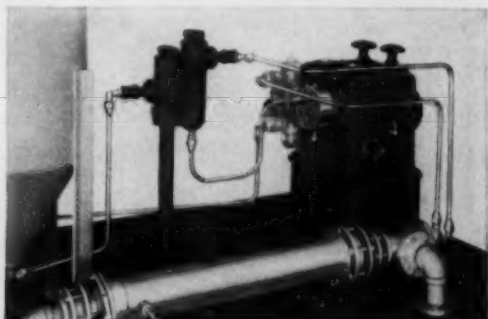
The smooth, pulsation-free delivery of the %Proportioneers% Constaflo insures the unvarying addition of chemicals in pilot plants or commercial processes. Here at last is a pump which eliminates the possibility of reactions misfiring due to pulsating additions of material!

The Constaflo is a duplex diaphragm pump of the same high quality design and construction as other %Proportioneers% units. Driven by a motor through belt and pulleys, the new pump has three rates of speed. Its features include adjustment in operation over its full range . . . no stuffing boxes . . . transparent "See-Thru" plastic (methyl metha-

crylate) heads to enable operator to check operation visually. When required, heads are also available in Saran, Polyethylene, steel, stainless steel, and other materials. For handling chemicals which attack plastics, the Constaflo can be supplied as an indirect displacement unit. The entire mechanism operates in an oil bath which reduces maintenance to a minimum and greatly increases the life of the pump. The Constaflo is available in capacities of 16, 25, or 30 gph and pressures from 60 to 100 psig, and is supplied complete with all accessories for installation. Write for descriptive literature and prices.



Standard installation for "easy-to-handle" chemicals



Indirect displacement for "hard-to-handle" chemicals

## % PROPORTIONEERS, INC. %

Write to %PROPORTIONEERS, INC., 369 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.



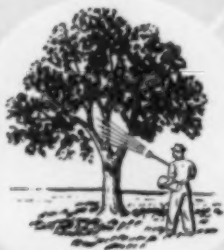
**CHEMICALS**



**CATALYSTS**



**WELDING ROD  
COATINGS**



**INSECTICIDES**



**SIMPSON** Mix-Muller Division

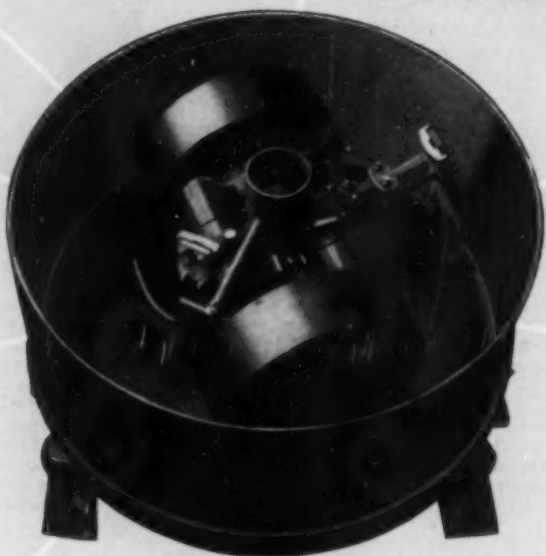
NATIONAL ENGINEERING CO.

604 Madison West Side, Chicago 6, Ill.



## No Mixing Job is Too

**GRAPHITE LEADS  
AND CRAYON STOCK**

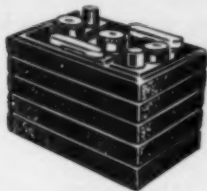


### ... NO PRODUCTION SCHEDULE TOO RIGID FOR THE MULLING PRINCIPLE OF MIXING

In the Simpson Mix-Muller you have a modern production machine embodying a time-tested mixing principle. For the true mulling principle is similar to the rubbing, kneading and smearing action of a mortar and pestle. This assures a more thorough, more accurate blend of all materials ... and every batch is exactly the same for complete product uniformity.

Simpson Mix-Mullers are built in capacities ranging from 1/10 to 30 cu. ft. They may be specially equipped for heating or cooling while mixing—for mixing under vacuum or pressure—for corrosive materials—or to function as a reaction vessel.

## Special for SIMPSON Mix-Mullers



STORAGE BATTERY PLATE COATINGS



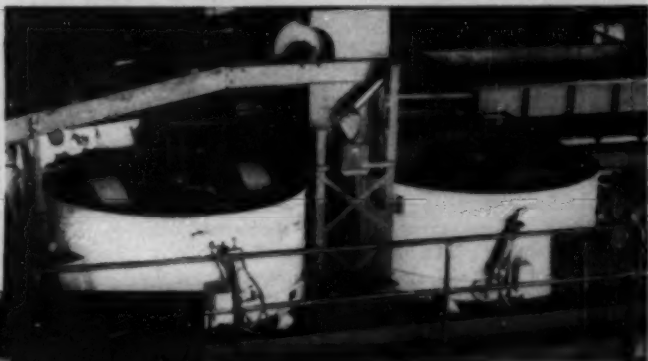
FERTILIZERS

Right: Two Simpson Mix-Mullers operating in the briquetting unit at the Godwin, Tennessee, fertilizer plant of T.V.A. They are arranged for automatic control. Below: Two Simpson Mix-Mullers used for the preparation of storage battery paste.

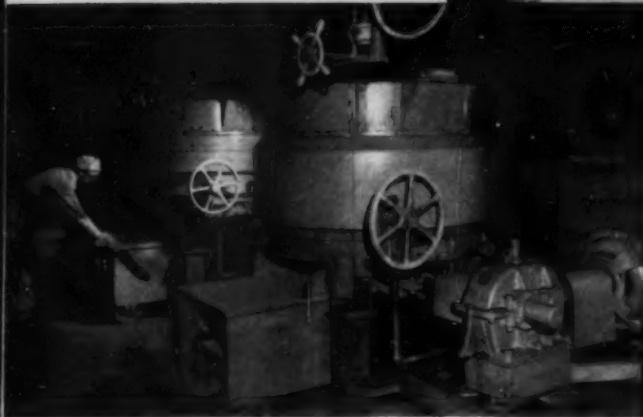
**WHETHER** your plant processes catalysts, battery paste, insecticides, fertilizers, or any other dry, semi-plastic or pasty materials—the job can be done faster, more accurately, and at less cost with Simpson Mix-Mullers.

These are important considerations—especially today when expanding defense requirements call for stepped-up output and when product quality is most vital to ultimate consumers.

Simpson Mix-Mullers have been job-tested and proved in scores of chemical-process applications. Ask a National Engineer to show you how this experience can help your mixing operation.



Write for complete details covering the use of Simpson Mix-Mullers to meet your individual requirements . . . or send for a copy of our latest Chemical-Process Mixing Catalog.





### THE CHEMENTATOR, continued

percent of the benzene Petroleum Administration for Defense has called on the refiners to make. In addition, California Standard's unit is designed to turn out 48 million gallons of toluene, urgently needed for aviation gasoline.

Raw material will be a light fraction boiling in the same range as gasoline. Presumably, it will be rich in methyl cyclopentane or cyclohexane. These can be dehydrogenated by heating and passing through reactors containing fixed beds of platinum catalyst, yielding benzene.

Output of the new plant could be gobbled up by the booming synthetic rubber industry in the Los Angeles area. Dow, for example, could use it to make styrene, GR-S component, at its plant there.

Shell Oil Co., in the same vicinity, is currently synthesizing benzene, but by a different process. The Shell process entails catalytic isomerization of methyl pentanes to cyclohexane, dehydrogenation of cyclohexane to benzene, and extractive distillation to separate the benzene. In essence, that's the process Shell used during the last war to make toluene.

California Standard's decision to build the new benzene unit comes against another wartime backdrop, with Washington urging refiners to turn out benzene for the manufacture of such essentials as synthetic rubber, aniline, plastics, agricultural chemicals and detergents.

### Waste wood: untapped alcohol source

Nearly 210 million cubic feet of unused wood resources is available annually in the state of Washington, the Institute of Forest Products at Seattle reports. Equivalent to more than 800,000 tons of wood pulp, the material accessible to tidewater alone would support five kraft paper mills.

On a statewide basis, it could be converted by hydrolysis of wood wastes into 140 million gallons annually of industrial alcohol, now urgently needed for the defense program.

"In the past," explains Ralph G. DeMoisy, technical director of the Institute, "much of the unused wood could not be handled because it would not pay its way to suitable markets. With the continuing development of new uses and favorable markets for wood and improved methods of harvesting small timber, utilization of leftovers is becoming increasingly more attractive."

### Patent agreement on cortisone production

Four pharmaceutical companies, working with Research Corp., have pooled their patents on the production of cortisone. The four: Ciba, Merck, Organon and Schering. All own patents involved in the present 37-step process for producing the hormone from desoxycholic acid. The agreement untangles a

difficult patent snarl, making it possible for other companies to get licenses for the production of cortisone.

Any firm can get a license from Research Corp. if it makes available to the industry, on reasonable terms, any rights it has to the production of cortisone from desoxycholic acid. Those getting licenses before May 1, 1951, will have to make available their rights that existed on September 20, 1949, the date on which the parties to the agreement surrendered their own rights. Those obtaining a license after May 1 will be required to give up any rights they have at the time of licensing. Each company retains the right to license its own patents independently.

Research Corp. initiated the negotiations with the four pharmaceutical manufacturers, as well as with the Justice Department's Office of Alien Property, which owns Schering.

### Chemical wages tied to cost of living

The General Motors labor contract provides the pattern for a new labor agreement reached at Seattle, Wash., between Monsanto and Local 121 of the International Chemical Workers' Union, AFL.

The agreement provides an 8½ c. hourly wage increase, retroactive to December 1, with additional wage increases of 4 c. an hr. specified for Dec. 1, 1951, and Dec. 1, 1952. Further, with each increase of 1.14 points in the cost-of-living index of the Bureau of Labor Statistics, wages will increase 1 c. an hr.

Average hourly wage at the Monsanto plants in Seattle is increased to \$1.85 by the contract.

### Davison: front runner in fast field

First in 1942 to produce commercially a synthetic fluid cracking catalyst, Davison Chemical Corp. is today most probably the biggest producer of these catalysts. Its output: close to a spanking 40,000 tons per year.

What's more, Davison's capacity for production of these catalysts at its Cincinnati plant will be substantially increased this year. New facilities for the manufacture of the microspheroidal type of synthetic fluid catalysts by the spray-drying process will go into operation.

### Ethylene for hungry Gulf Coast plants

World's biggest ethylene unit will be built, within the next year, at Port Arthur, Tex., by Gulf Oil. It will separate and crack gases from Gulf's refinery. Annual output will be 2.5 million cubic feet, enough to boost current U. S. production by 12 percent.

Pipelines will carry the ethylene to Gulf Coast chemical plants. A six-inch line will run 32 mi. to Du Pont's polyethylene plant at Orange, Tex., while an eight-inch line will stretch 76 mi. to the tetraethyl lead plant of Ethyl Corp. on the Houston Ship Channel at Pasadena. A smaller pipeline will deliver ethylene to the new Koppers plant to be built near the Port

(Continued on page 78)

## NEWS NOTE:

Suppliers announce that more sulfur is now being consumed than is presently produced . . . urge conservation and more efficient use of available materials.

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# Sulfan

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

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gation, but it offers a number of other important efficiencies and economies, too. So, if you sulfonate in the manufacture of the products listed here, learn more about SULFAN without delay. A confidential letter outlining your particular requirements will enable us to supply information of immediate practical value. Write today on your business letterhead to:

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**FOR AMERICAN INDUSTRY**

Product Development Department

## GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

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\* "SULFAN" is General Chemical's registered trade-mark for liquid sulfur trioxide

### **THE CHEMENTATOR, continued**

Arthur refinery. Despite reports, the pipeline system will not extend west of Houston.

The only pipeline system heretofore delivering ethylene has originated in Texas City. Carbide & Carbon has piped the chemical 50 mi. through a four-inch line to Dow's plant at Freeport and through a two-inch line to Humble Oil's Baytown refinery, a distance of 30 mi.

### **Mexico cuts sulphur exports**

There's no official connection between U. S. action on cutting sulphur exports recently and Mexican action in cutting exports. Mexican Ministry of Economy says no export permits will be issued until Mexican needs, amounting to about 11,500 metric tons a year, are satisfied. Then, countries using sulphur for production of materials for Mexican industry will get top priority.

### **Horizontal tray vs. bubble cap**

The horizontal design of Koch Engineering Co.'s new Kaskade distillation-column tray offers advantages over conventional bubble trays for many applications. The new tray permits a high degree of operating flexibility.

Its biggest advantage is that it makes possible 30 to 40 percent more fractionation for a given pressure drop than a bubble tray does. Pressure drop for a given degree of fractionation is extremely low—even as little as 1 mm. per tray. The new design is particularly useful for high vapor and moderate to low liquid loads.

Liquid-liquid extraction may be an important application, since the tray is more efficient than a packed tower. Tower height for a given extraction conceivably can be halved. The low pressure drop that makes this possible also makes the new design extremely valuable for liquid-liquid systems where the gravity difference between the two phases is very small. Commercial towers have been operated where the difference in specific gravity is as low as 6 percent.

If the continuous phase is the lighter of the two, the tray is generally used in the normal position. But if the heavier phase is the continuous one, the tray is often inverted.

Here's how the Koch horizontal tray works. Liquid reflux from the plate above passes into a liquid well. From this, it pours onto the plate, made in two sections. The lower section of the tray consists of a series of solid metal strips, all curved in the same direction. Vapor rises between these curved strips, hits the liquid reflux pouring across the top, and throws it against a series of vertical screens set above the curved section. The screens act both as contacting device and means of separating liquid from vapor. This operation is repeated on the next tray.

Cost of the new horizontal tray is roughly the same,

for a specific job, as that of a bubble cap tray. But there's a saving on the tower itself and its foundations, since smaller trays are required. Maintenance of the new tray is about 50 to 75 percent of the cost of maintaining the same square footage of bubble trays. What's more, there are fewer square feet to maintain when the new horizontal tray is used.

### **Higher alcohols by Oxo synthesis**

Watch for a quickened cadence in oncoming Oxo process developments. Scarcity and climbing price of ethyl alcohol, from which 2-ethylhexanol for plasticizers is made, most likely will flush out a covey of iso-octyl alcohol producers. Gulf Oil, for example, expects to be making iso-octyl alcohol in a new unit at its Port Arthur, Tex., refinery before the end of the year. Other oil and chemical companies will probably convert high-pressure equipment to its production.

In the Oxo process, an olefin is reacted with carbon monoxide and hydrogen to lengthen the hydrocarbon chain by one carbon atom, producing an aldehyde. Next, the aldehyde is hydrogenated at high pressure (about 3,000 psi.) to produce a higher alcohol. Acids, amines and a host of other derivatives can thus be made from olefin hydrocarbons.

### **Champion adds chlorine cells**

More chlorine cells are being installed at the Pasadena, Tex., plant of Champion Paper & Fibre Co. Twenty cells are being added to the installation of 85 Hooker cells put in when the plant was built.

Champion needs the chlorine for bleaching pine and hardwood pulps. And at least part of the caustic can be used in its bleach treatment operation.

### **Fuel oil replaces costly absorbent oil**

Fuel oil has been successfully substituted for special oils in the recovery of light oil from coke-oven gas at the plant of Pittsburgh Steel Co.

For many years operators have used a special high-boiling petroleum oil in recovering light oil from coke-oven gas. This special oil has to meet close specifications as an absorbent oil. Pittsburgh Steel decided to test other oils as possible substitutes for the expensive absorbent oil.

During and since the changeover, a careful watch has been kept on operating conditions and data on recovery of light oil have been recorded. As an upshot of the tests, Pittsburgh Steel has since been using gas oil as the absorbing oil in its light oil recovery system. Chief chemist C. R. Montgomery of the company's By-Product Coke Division reports these results: (1) recovery has not suffered; (2) the system has remained as clean or cleaner with this oil; (3) products have retained their quality; (4) the company is saving 4½ c. a gal. on the oil delivered.

—End



## HANNAH JONES IS ROUGH ON

*Soda Ash*

Hannah probably doesn't know it, but the glasses she handles every day contain one of the most widely used of all industrial chemicals. The largest single consumer of soda ash is the glass industry, where it is an essential raw material in regular glass formulas.

But the demand for this basic chemical is great in other fields, too. The chemical industry itself uses an enormous tonnage of soda ash in the manufacture of other chemicals. Other industrial consumers include soap, cleansing powders, pulp and paper, textile, iron and steel, aluminum and non-ferrous metals.

With new and expanding uses supplemented by needs for defense, the problem of producing adequate supplies for all is acute. To help meet this increased demand Mathieson is expanding its basic alkali production. Inquiries are always welcomed from con-

sumers who desire assistance in solving a future soda ash supply problem. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

### Mathieson Basic Heavy Chemicals

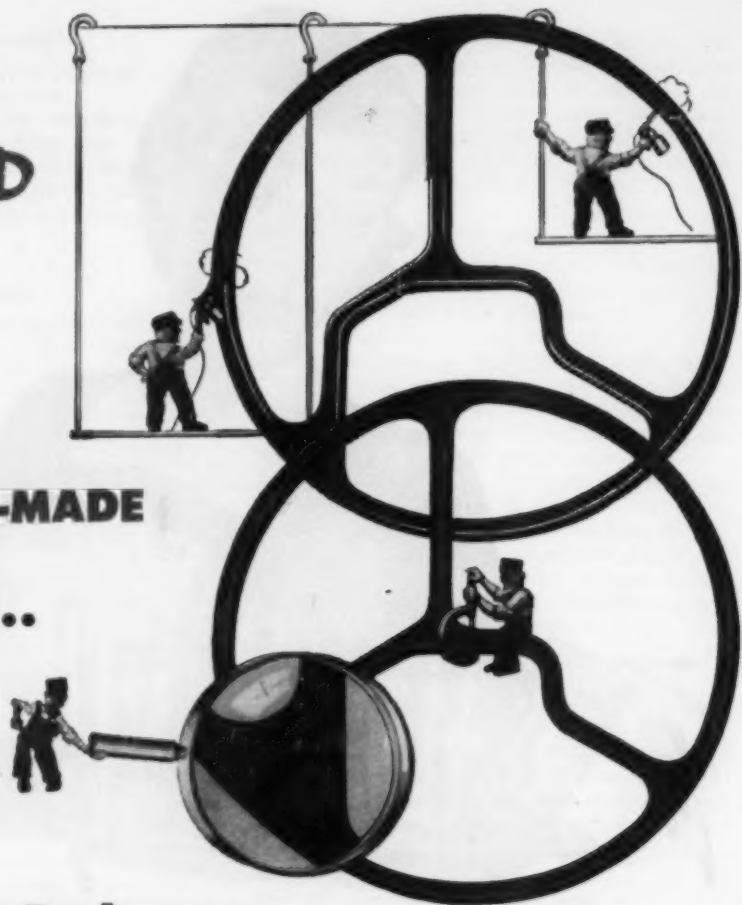
Sulphuric Acid • Processed Sulphur • Soda Ash  
Caustic Soda • Bicarbonate of Soda • Ammonia  
Ammonium Sulphate • Nitrate of Soda • Chlorine  
Calcium Hypochlorite • Sodium Chloride

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CHEMICAL ENGINEERING—March 1951

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to resist  
rust...

**PRECISION-MADE**  
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**...this Heat Exchanger  
Gasket will stay on the job longer**

The durable coating of red paint on every Goetze iron or steel-jacketed Style 923 Heat Exchanger Gasket is a sure "stop light" against rust. And rust, as every metal gasket user knows, is a primary cause of deterioration—both in the storehouse and on the job awaiting installation.

Equally important in the fabrication of Style 923 is the precision

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"Custom tailoring" accounts for the meticulous care which is taken in the forming of every one of these gaskets...care which results in a long, efficient service life. You can always depend on a Goetze Style 923 to fit

and seal perfectly...to stay on the job without leaks or blowouts. And that, of course, pays off in less down time and fewer gasket replacements.

Find out how little it costs to have Goetze Heat Exchanger Gaskets "tailored" to the size and shape you need. For prompt estimates and recommendations, write Johns-Manville, Box 290, New York 16, N. Y.



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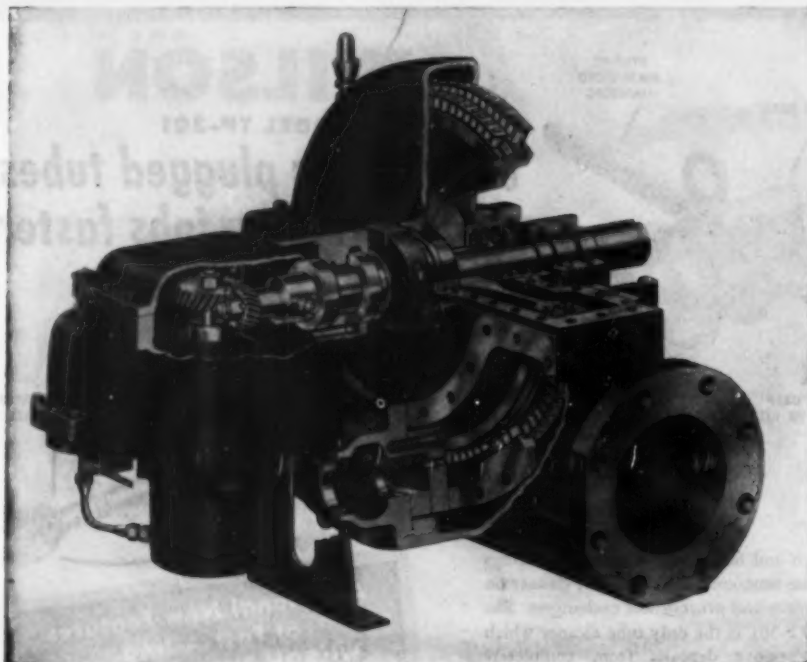
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Type

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Since the introduction of the DP turbine, more than two years ago, General Electric has been telling mechanical-drive turbine users that their best turbine buy was a *standard* design, wherever it could be properly applied. Nowadays, with the emphasis on increased output, the advantages which turbine standardization offers are even more important.

Standardization means that turbines of different rating and size have mostly identical construction features. This speeds delivery, cuts manufacturing costs, makes possible a better design and a better turbine. If you're not familiar with the General Electric DP, we suggest that you contact your nearest G-E sales office or send for a copy of bulletin GEA-

4955, "A New Standard in Mechanical Drive Turbines." Write to *Apparatus Dept., General Electric Company, Schenectady, N. Y.*

## **GREATER RELIABILITY**

From its totally enclosed governor to its durable babbitt-faced bearings, General Electric's DP turbine is built to provide greater productivity through greater reliability. Standardization has made possible "extras" such as pressure lubrication, Monel-sprayed shaft, self-positioning packings, a totally enclosed hydraulic governor. You can count on your DP for safe, dependable service in hazardous atmospheres and on tough, continuous-process assignments.

# ***DRIVE IS A STANDARD***



This DP drives a centrifugal pump in a refinery



Standard spare parts kits are available with all DP turbines

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In plants which require shifting of equipment from job to job, a standard DP frequently eliminates the need for extra drives. Because most parts are identical for all ratings, speed range and shaft horsepower can be easily and economically changed to fit new conditions. Though the DP's 30% adjustable speed range is usually adequate, a new range can be set anywhere from 800 to 5000 rpm simply by substituting a new emergency governor and governor gears. A change in horsepower rating usually requires a new nozzle plate and a few valve parts. These parts are all available on immediate delivery and save the expense of a new turbine which would be required with a less flexible, non-standard unit.

## **EASIER, QUICKER MAINTENANCE**

Because most parts of standard DP's are interchangeable on all models, spares can be easily stocked, and maintenance work handled quicker. You can have delivered with the turbine a 91-item spare parts kit, sufficient to service several machines. Socket-head cap screws are used throughout for quick disassembly. Standard shaft height, keyways, and coupling fits simplify installation. You can move DP's from job to job without change in the base structure.

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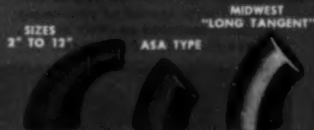
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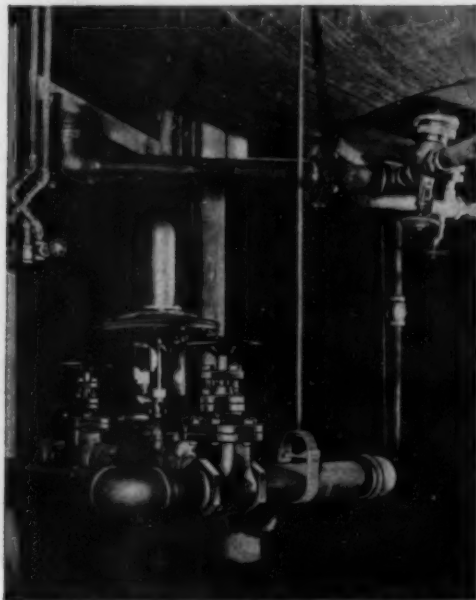


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Splashing liquids, outdoor service, chemical fumes. You'd have to look a long time to find a motor and starter that take this kind of corrosive service as well as the matched Life-Line chemical motor and Life-Linestarter®.

The special enclosures of Life-Linestarters are extra protected to ward off corrosion. Castings are sprayed with iron-oxide, zinc-chromate primer; then, finished with aluminum lacquer. A neoprene gasket between covers seals out corrosive elements.

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The Complete Line includes valves  
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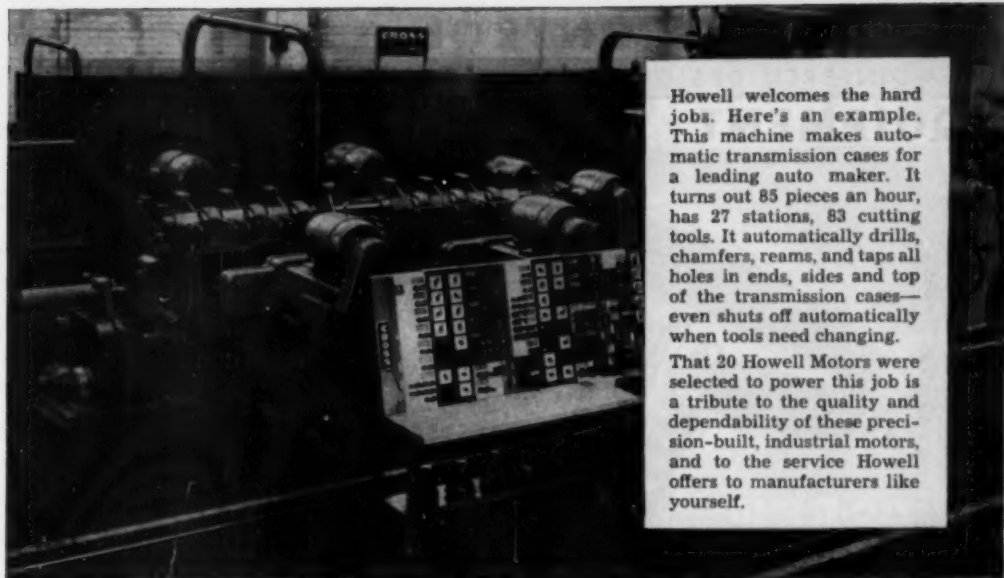
*Quality fine  
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"The Line"*

Fig. 1779. A large 125-pound  
and 8-inch Square Stemmed Gate  
Valve for low pressure steam,  
oil, water and gas service.



**POWELL**

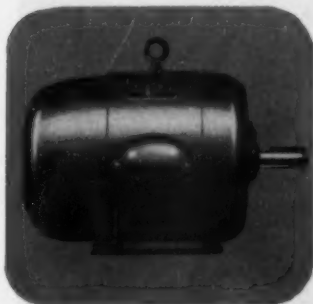
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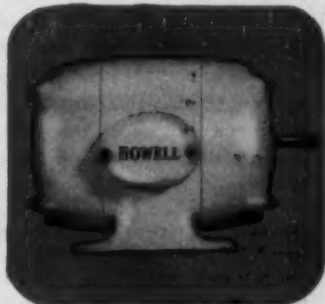
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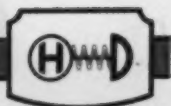
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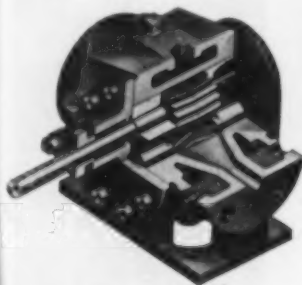




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The SK Steam Jacketed Herringbone Gear Pump shown in the break-away drawing is designed to handle viscous liquids such as resins, asphalts, and road oils at high temperatures efficiently and economically.

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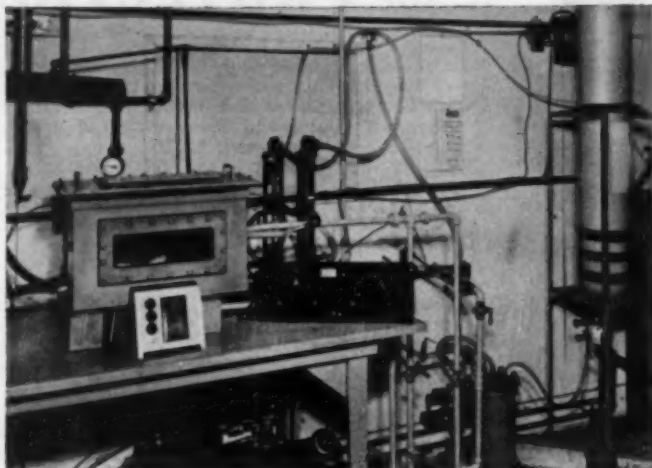
any possibility of distortion due to pipe line strain or misalignment. Straight bore housing also prevents shaft deflection and bearing overhang.

Shafts are of heavy duty alloy steel finish ground. Pressure on the stuffing box is dissipated through a channel in the cover plates. Steam connections on the jackets are designed to permit a variety of piping arrangements. Complete rotor and bearing assembly can be removed as a unit by releasing the coupling and removing the rear cover.

Pumps are available in Meehanite B, cast steel, bronze, or special alloy case. Internal parts are built to specifications.

For details on SK Steam Jacketed Pumps, request Bulletin 17-A, Supplement SJ.

## SK Rotameters Control Flow In New Gas Plating Process



A new gas plating process under development at Commonwealth Engineering Company of Ohio utilizes the volatility and decomposition characteristics of certain metallic compounds such as carbonyls, nitrosyls, hydrides, salts, and metal organics to plate both metallic and non-metallic materials. Results of this process are similar in many respects to those obtained by electro-plating, however, gas plating permits the plating of non-conductors of electricity such as paper, plastics, tile and other non-metallic materials.

In this new process, SK Rotameters play an important role. In the pilot

setup shown above, one SK Fig. 1891 Universal Rotameter is used to control the flow of carrier gas, usually carbon dioxide, while another is used to control the flow of nickel carbonyl-carrier gas mixture as it comes from a carburetor. Since the ratio between the nickel carbonyl and the carrier gas determines, to a considerable degree, the character of the films deposited, the importance of providing such accurate flow measurement can be realized.

SK Universal Rotameters are available from stock. For detailed information, write for Bulletin 18-RB.

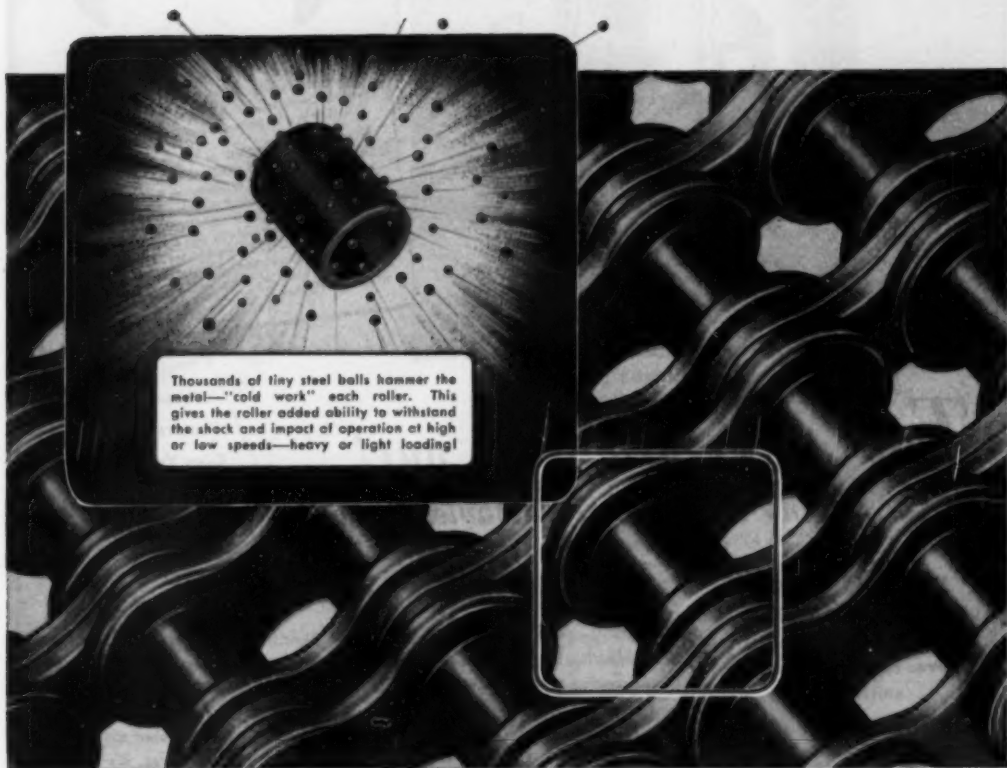
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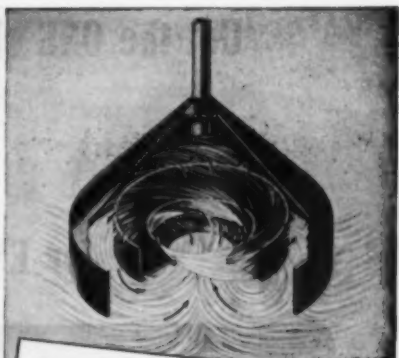
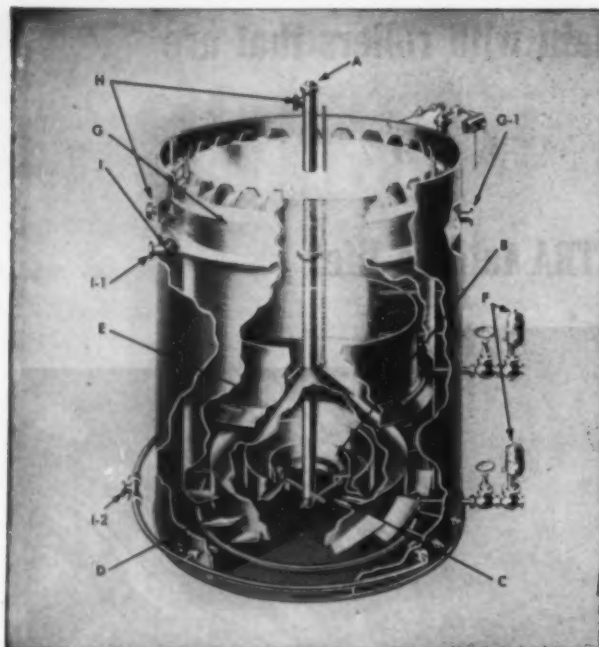
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Vortex mixing eliminates need for submerged moving parts in the Worthington Cold Process Slurry Type Precipitation Water Softener and Coagulator.

**REACTION TANK** of Worthington Slurry Type Softener (Slurry bed eliminated for clarity). (A) Raw water influent line. (B) Vortexor for optimum slurry production. (C) Chemical Applicators. (D) Slurry bed portionate sludge removal. (E) Symmetrical Slurry concentrator. (F) Portionate sludge removal. (G) Collector trough for preliminary recirculation. (H) Treated water effluent. (I) Filter wash water suction. (I-2) Filter wash water return.

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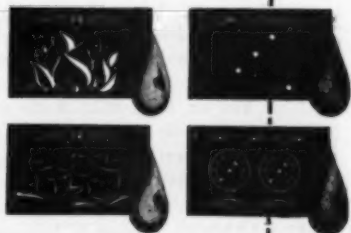
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CHEMICAL ENGINEERING—March 1951

99



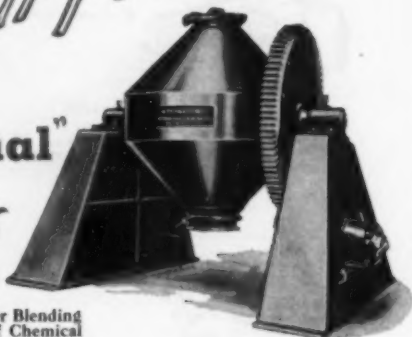
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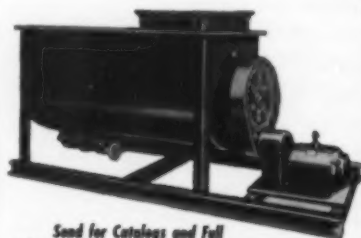
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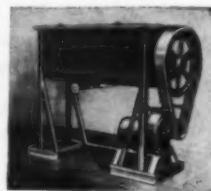


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## Memo from the Editor *John R. Callahan*



### An Irishman Covers the Midwest

Our new Midwest Editor, Frank Byrnes, is a lean, six-foot Irishman with a true Gaelic sense of humor—the kind that flashes from fantasy to lustiness in a split second. As for jokes: "I've got millions of 'em," he says with proper Irish lack of modesty—and off he goes!

Those anecdotes were one of the reasons my first interview with him last November in Chicago lasted close to four hours. But I did manage to find out plenty about Frank: his real liking for people, his wide chemical and industrial background, his avid interest in finding out about new things, his curiosity about what's going on.

Frank got his chemical degree from the University of Chicago in 1941, minoring in geology. He paid his way through the University by working evenings at the Chicago Public Library. "Sure," he says, "I reshelfed 369,607 books in 5½ years—and I still love to read!"

When working in St. Louis, Frank took up metallurgy and got a degree in it. Later, in Chicago, he couldn't resist taking a year's course in lubrication engineering; he finished this in 1948. Lately he's been talking about more evening courses in chemical engineering.

Frank's first job in the chemical industry was as a plant operator in Seagram's alcohol unit at Louisville. He then went with United States Cartridge Co. in St. Louis. There he was supervisor of the plant's first brass

annealing units while his father, a design engineer, was putting the final touches on the last units. Frank later became chief chemist of the plant, which made primers, tracers and incendiary mixtures.

After four years at U. S. Cartridge, Frank's hankering for the sea prompted him to join the Navy. For 14 months he was a schoolgoing (not seagoing) sailor, ended up as electronics technician's mate.

When the Navy discharged him, Frank went to work as plant chemist in one of General Chemical's sulphuric acid units. Later he spent several years as a researcher with petroleum products for International

Harvester's manufacturing research division. We found him as assistant chemical purchasing agent for Darling & Co., fertilizer manufacturers, in Chicago.

With all this background and experience in Midwest industry, we decided Frank was just the man to cover the area (see map) for *Chemical Engineering*. He travels the whole territory, but has his headquarters at the McGraw-Hill building in Chicago.

When you really get to know Frank you'll find him one of the "hobbyingest" guys that ever lived. His major hobbies are photography, pipe-making (see cut above), leathercraft, stamp collecting, song writing, reading, tennis, mineral collecting, cave exploring, pen-and-ink sketching (he once did commercial art work).

He even has "hobbies within hobbies"—making his own tools for working with pipes and leather, drawing original album pages for his stamps, binding his own books, singing his own songs! Wife Pat, it follows, is a patient soul, God bless her.

Frank has dabbled in "writing" since he was a kid. He was science editor of his high school paper, editor-in-chief of his college science honor society publication.

His first big break into print was with an article called "The Secret of Living Light," published by the Chicago Academy of Sciences. Even at 19, Frank couldn't resist giving a Gaelic twist to this serious work by concluding that "... it would take a great number of square yards of firefly rump to illuminate a room properly."

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MARCH 1951

## Beat the Manpower Crisis Now

The heat is on the chemical process industries for more production and higher productivity. More output can be had by putting in more and better facilities. This takes time and money; besides, there's a practical limit.

Higher productivity, then, is the thing to concentrate on now. This means better, more efficient use of both men and machines. But with equipment more difficult to get, productivity of your plant hinges largely on your labor and technical manpower—how effectively they are used.

For one thing becomes clearer with every passing month: industry—including the chemical process industries—will soon face an acute manpower shortage. It will come this year, will probably be as bad or worse than anything we saw during World War II. The nation simply doesn't have the manpower to turn out the flood of war-and-peace goods that will be demanded—unless labor productivity is vastly improved.

How effectively are you using the labor and technical men in your plant? What plans are you making to increase their effectiveness—or to keep it from dropping? Have you assigned one person the job of finding workers, keeping workers, training workers? Or is your program haphazard, opportunistic, split in responsibility? Will your plant be prepared to buffer the crisis when it hits with full force?

Be certain that you're getting the best out of your men—technical, supervisory, operating, maintenance and service. And the best comes only when there is voluntary and enthusiastic cooperation. It's up to you, then, to see to it that every person throughout your organization understands the critical importance of higher productivity in this war of production against communism throughout the world and of disastrous inflation and controls at home. It's up to you to provide the incentive and the enthusiasm that bring out

the most productive ideas and efforts from everyone. There is no better way to increase any plant's productivity.

Have you made plans to take the next step: to train and upgrade your labor and technical personnel in a systematic manner? Or do you still have persons that haven't been given a chance to do a more important job? Here's the advice of one smart and successful chemical plant manager: "Never saddle a man to a job that someone else can do as well or better—and cheaper."

You will find that keeping your good workers will get tougher as the year progresses: job opportunities in other industries and plants will be made more attractive, the temptation to leave harder for them to resist. What plans do you have to prevent an exodus from your plant? Are you preparing to use all the little tricks to "keep your pasture always greener than your neighbor's?"

Finally, you may have to increase your labor force and technical staff. The competition here is keen, will get keener. Will you be able to compete? Or will your production fall off for lack of manpower, your productivity dip because you can't get or keep first-class personnel?

We are convinced that the chemical process industries will face a manpower-productivity crisis this year. We are convinced that planning now is vital—that how soon and how well we do this will have an important effect on the outcome of our production race against world communism and domestic inflation.

We therefore urge every responsible person in chemical process industry plants to start serious planning now. For a reminder on some of the things that can be done, take a look at the material on p. 127 in this issue.

Plan now to meet—and beat—the coming manpower crisis.

*John R. Callahan*

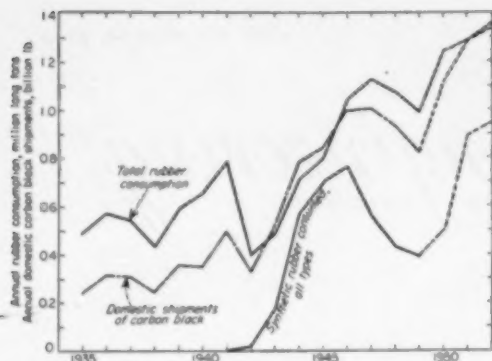


Fig. 1—Carbon black usage closely parallels rubber consumption. Unit usage jumped as synthetic came into the picture.

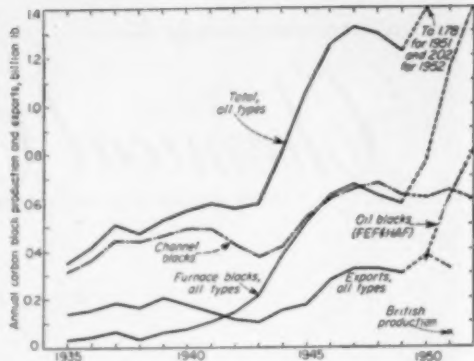


Fig. 2—Production curves for carbon black show growing dependence on the furnace processes. Note oil black spurt.

# Carbon Black

The carbon black industry, expanding rapidly, is in the midst of a technologic revolution involving a shift from natural gas to oil, as well as from the channel process to furnace processes.

GORDON KIDDOO

Except for about 5 percent of the production of carbon black which is consumed in printing inks, paints, plastics and many other applications, virtually all this product goes into rubber to improve its wearing qualities. Early in the century, before it was widely used, automobile tires averaged only a few thousand miles. Now, thanks largely to the use of better carbon blacks, 40,000 or more miles per tire is common. Fig. 1 shows the close correlation that exists between the consumptions of rubber and of carbon black.

Carbon black consists of extremely fine particles, roughly spherical in shape, ranging in diameter from 10 to 150 millimicrons. The particles themselves are composed of much

smaller crystals, similar to graphite, but smaller and less regularly oriented. Under the electron microscope the channel blacks and some of the furnace blacks appear to be regularly rounded or scattered agglomerates of spheruloids. Some of the newer furnace blacks, especially the high-modulus oil blacks, have a more chain-like structure. Particle size, crystallite size, structure and chemical composition all affect the utility of the carbon black, as does the chemical nature of the surface area, and the physical state of the black, that is, whether it is loose, compressed or pelletized.

Carbon black improves the physical characteristics of rubber compounds but it may also impart undesirable properties, such as increasing the heat

generated on flexing, or increasing cracking or checking. Although there are empirical methods for testing blacks and rubber samples which may give a good evaluation of the finished article, the final result can be determined practically only by testing the service life, which is why tire makers maintain test car fleets. Rubber manufacture is essentially a series of compromises and several different blacks are sometimes used in the same mixture to emphasize good and minimize bad effects.

Three different processes are used in making carbon black, each giving products of different and distinct qualities. These are the channel, furnace and thermal decomposition processes.

## CHANNEL PROCESS

The channel process (Fig. 3) makes use of thousands of fan-shaped smoky flames, produced by burning natural gas with a limited supply of air through small lava tips. The flames impinge on moving iron channels where the carbon black is deposited and from which it is later scraped off. A typical channel black plant covers many acres and in-

cludes from 50 to 1,200 burner houses, or hot houses, each approximately 150 ft. long, 12 ft. wide, and 9 ft. high, constructed of sheet iron. Running almost the entire length of each building and mounted on a track is a unit of 10 parallel steel channels, each 8-10 in. wide. About every 6 ft. along the length of the channels is fixed a hopper, extending across and underneath the 10 channels. Between every such hopper, and 2-3 in. directly beneath and parallel to each channel, is an iron burner pipe which can be raised or lowered. Each such pipe carries small slotted lava tips, spaced at 4-6 in., through which the gas flows.

Gas issues from each tip as a luminous, fan-shaped

GORDON KIDDOO is the technical director of the Continental Carbon Co., Amarillo, Tex. He was the author of our article on fluidized flow in the May 1949 Fluid Flow issue.



flame, at right angles to the length of the channels. The flame impinges and carbon deposits on the bottom flat surface of the channel which moves slowly back and forth over the tips. The black is then scraped off the channels by fixed scrapers mounted above each hopper along the length of each channel. The hoppers are served by screw conveyors which carry the black to the packing house.

All of the air for the combustion is controlled by natural draft openings in the top and bottom of the house. Draft control is entirely visual on the part of the plant operator. Air supply is generally adjusted so that the flames appear to be slightly deficient in air, with the top part of the building above the flames containing a blanket of suspended smoke. Although only about 10 volumes of air is required to burn 1 volume of natural gas completely, the air-gas ratio may range from 25 to 100 in a channel house. This excess of air does not completely burn the natural gas because the combustion time from the tip to the channel is very short, and because there is poor mixing of air and gas in this short interval. The large excess of air serves to hold the hot house temperature below a temperature of 1,000 deg. F.

Yield of carbon black from natural gas in the channel process depends to a considerable extent on the carbon content of the natural gas. For rubber-grade carbon black from the channel process the yield is ordinarily 1.50 to 2.25 lb. per M S.C.F. of natural gas. Based on the total carbon content of ordinary natural gas, which is about 35 lb. per M S.C.F., this yield is very low, only about 5 percent. It should be realized, however, that a part of the natural gas must be burned as fuel to heat the gas and air to reaction temperature and to supply the heat for cracking the hydrocarbons in the short available time interval. Therefore, the true yield of carbon black from the channel process is about 35 percent of the theoretically available carbon.

Many operating and mechanical variables affect the yield and quality of channel black, the most important being (1) carbon content of the gas, (2) size of the tip slot used, (3) gas rate per tip and (4) distance from the tip to the channel.

Color grade blacks used for inks and paints are produced almost exclusively by the channel process or by other impingement processes, in relatively small quantities at low yield. This is often less than 1 lb. per M S.C.F. of natural gas. Color blacks can also be manufactured by allowing the flame to impinge on a roller or rotating disk, from which the black is scraped into hoppers.

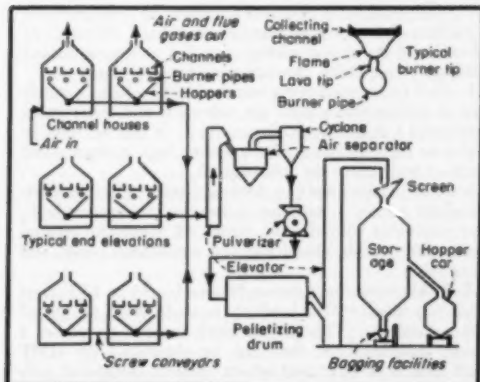


Fig. 3—Long the mainstay of carbon black manufacture, the channel process is now being eclipsed by furnace processes.

On leaving the hot house in the screw conveyor, channel black is usually subjected to these processing steps:

1. The black is passed in series through separators, in which mechanical agitation and air elutriation separates the light, fluffy black from any calcined carbon or scale from the conveyors. Grit, scale, and hard carbon remain in the bottom of the separators and are discarded and burned.

2. Carbon black from the separators is passed through cyclones where the black is separated from the entrained air.

3. Black is passed through a Mikro-Pulverizer to break up any remaining pieces of grit or carbon which might cause failure when incorporated into rubber.

4. Because the apparent density of the black at this stage is very low, only 1-5 lb. per cu.ft., it is difficult to handle. Therefore, its density is increased by one of several means:

Ink and color blacks are lightly agitated in closed bins to expel most of the air and to increase the density to 12-13 lb. per cu.ft.

Most rubber-grade channel black is converted into small pellets less than  $\frac{1}{8}$  in. in diameter, with a density of 20-25 lb. per cu. ft. The principal advantage of these pellets is that they can be shipped in bulk in covered hopper cars, can be handled in closed conveyor systems at the rubber plant, and are practically dustless. There are two principal pelletizing processes, wet and dry, and of each type there are several examples.

One commonly used dry pelletizing process utilizes one or more horizontal drums, 5-10 ft. in diameter and 20-40 ft. long, supported on steel rollers, and rotating at 5-10 rpm. The fluffy black is continuously fed in at one end of the rotating drum and the pellets continuously removed from the other end. Residence time is from 12 to 36 hr., the pellets being formed merely by the gentle agitation and rolling of the black in the drum.

In the commonly used wet pelletizing process, the fluffy carbon black is agitated and mixed with water in a trough by a shaft with radially projecting pins. The pellets thus formed are dried in a horizontal gas-fired rotating dryer drum.

5. The dry, pelletized carbon black is usually stored in vertical cylindrical tanks, each holding as much as 1 million lb., from which it can be discharged directly into hopper cars. About one-half of all channel black is so shipped. The rest of the black is put into multiwall paper

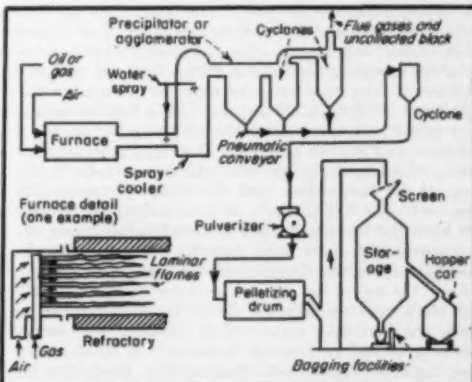


Fig. 4—Furnace processes (several types) accounted for 56 percent of 1950 production and will go considerably higher.



bags, each usually holding 25 or 50 lb., and is stored in warehouses or is shipped by truck or box car.

Because channel blacks remain on the channels for an appreciable time during which they are subjected to oxidizing atmospheres at elevated temperatures, their surfaces are composed of oxides of carbon and they are only 95 percent carbon, the remaining 5 percent being oxygen and hydrogen.

Channel blacks are classified principally on the basis of their ease of processing into rubber or their electrical conductivity. These classifications represent mainly the change in utility with change in particle size, although other physical and chemical properties also effect the classifications.

The principal types of channel blacks are: EPC, easy processing channel, MPC, medium processing channel, and HPC, hard processing channel blacks. EPC is the softest of these blacks, has the largest particle size, and is the easiest to process, or to compound and mix into either natural or synthetic rubber. It is by far the most commonly used grade of channel black. HPC, on the other hand, is the most difficult to process of the channel blacks and has the smallest particle size. Although it is harder to process into rubber, it adds more reinforcement than do the other grades of channel blacks usually used in rubber. The properties of MPC black lie between those of the EPC and HPC blacks.

In general it can be said that channel blacks find their greatest utility when compounded with natural rubber. They are of special value in heavy-duty truck and bus tires, where high heat build-up is encountered. Natural rubber compounded with channel blacks is generally preferred for low heat build-up, compatible with satisfactory abrasion resistance.

#### COMBUSTION FURNACE PROCESS

The combustion furnace process (Fig. 4) is similar to the channel process in that it involves the incomplete combustion of natural gas or other hydrocarbons. It differs in using fewer but larger flames, contained in a refractory combustion chamber. Typically, a furnace plant consists of one or more furnaces or combustion chambers, a duct leading to a cooling tower, a cooling tower, an electrostatic precipitator, several cyclones for separating the black from the combustion gases, and conveying, bagging, and storage facilities.

Into the combustion chamber whatever source of carbon used is continually introduced. This may be natural gas, liquefied petroleum gases, natural gasoline, gas oils, fuel oils, or residuum. From 4 to 8 volumes of air is used per equivalent volume of methane. Insufficient air is introduced for complete combustion of the fuel, but sufficient combustion does take place to maintain a furnace temperature of 2,000 to 3,000 deg. F. This is high enough to crack part of the unburned hydrocarbon to carbon black, hydrogen, and gaseous products. The furnace temperature is determined by the air-gas ratio, the flow rate, the turbulence of the combustion, and the extent of combustion permitted. The hot products of combustion and cracking pass from the furnace through a refractory-lined duct and are quenched by direct water spray to 500 to 600 deg. F., somewhat above the dewpoint of the gas.

From the top of the vertical spray cooler, the flue gases and black pass through an electrostatic precipitator in which the very fine carbon black particles agglomerate into large enough particles for subsequent removal in two-stage cyclones. The second-stage cyclone allows the hot flue gases and uncollected carbon black to pass to the atmosphere, while the collected black is removed from hoppers at the bottom of the precipitator and each

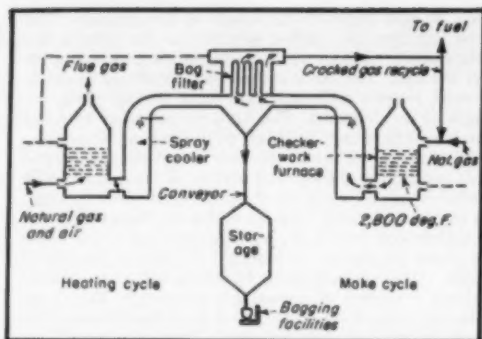


Fig. 5—Thermal decomposition processes account for a small but important output of carbon black for special purposes.

cyclone. From these the black passes through conveying, pelletizing, bagging, and storage facilities similar to those used for channel blacks. As furnace black pellets are generally not as strong as those made from channel blacks, however, most of the furnace black production is shipped in bags rather than in bulk.

Many variables affect the type, quality, and yield of black produced in the furnace processes. Many of the design features of a furnace plant are empirical and can be evaluated only by trial and error. For these reasons, furnace designs and operating techniques are varied and a number of combustion furnace processes for the manufacture of carbon blacks are used in the industry. As with the channel black process, the greater the carbon content of the hydrocarbon feed, the greater is the yield of carbon black. Of importance in the manufacture of oil blacks is the fact that aromatic hydrocarbons are easier to crack (i.e., require less energy) than aliphatic hydrocarbons. Therefore, under similar design and operating conditions, the higher the aromatic content of the oil feed, the higher is the yield of carbon black. In general, the lower the reinforcing properties of the furnace black when compounded in rubber, the higher is the yield of that black.

Furnace blacks are essentially pure carbon, the principal impurities being ash, or salts from the water used to quench the reaction and to cool the flue gases and black, and extractable organic matter.

Furnace blacks are classified according to reinforcement of rubber, electrical conductance, or particle fineness. In the order of decreasing particle size and increasing rubber reinforcing properties, the principal furnace blacks are:

1. SRF (semi-reinforcing furnace black) which is widely used in mechanical goods, tire sidewalls, and inner tubes because (1) it is easy to process, (2) it can be used in rubber at high loadings, (3) it retains high resilience and low heat build-up in the rubber stock.
2. HMF (high modulus furnace black) which imparts to rubber stocks a modulus more nearly comparable to that obtainable with channel blacks. It is used for natural and synthetic rubber tire treads, for mechanical goods, and inner tubes.
3. MAF (medium abrasion furnace black) or FEF (fast extruding furnace black) which is made from oil, or oil and natural gas. This carbon black imparts to rubber a greater reinforcement than can be obtained with HMF black and is widely used where smooth extrusions with minimum shrinkage are desired.
4. FF (fine furnace black) which is of lesser importance than the other furnace blacks in this listing. It is a

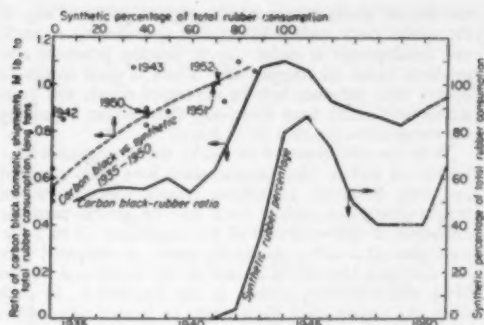


Fig. 6—How carbon black-rubber ratio has varied since 1935; note dotted curve showing ratio vs. synthetic rubber percent.

so-called "low structure" black with a fine particle size, producing relatively low-modulus rubber stocks, but with high electrical conductance.

5. HAF (high abrasion furnace black) which is the principal "oil black." This black imparts to both natural and synthetic rubber—and especially to "cold" synthetic rubber—a high degree of reinforcement and abrasion resistance, making it exceptionally useful in tire tread manufacture.

#### THERMAL DECOMPOSITION PROCESS

Less than 5 percent of all carbon black is manufactured by thermal decomposition of natural gas. When natural gas is brought into contact with hot refractory surfaces (Fig. 5) and held at an elevated temperature for sufficient time, it decomposes into carbon, hydrogen, and cracked gases. The apparatus necessary for this process consists essentially of a number of furnaces (converters) filled with checker firebrick, plus equipment for cooling and collecting the black. The operation is cyclic, with a heating period and "make" period. In the heating period the combustion of natural gas or other combustibles with air heats the furnace to 3,000 deg. F. Then the combustion is stopped and natural gas is fed into the furnace and thermally decomposed to carbon black, hydrogen, and cracked gases.

The cracked products pass from the furnace and are cooled by a water spray. The carbon black is separated in bag filters or by water washing and is subsequently filtered, dried, pulverized, screened, and bagged. The cracked gases may be used for ammonia production (because of the high hydrogen content), for fuel, or as a diluent in natural gas during the make period to control the quality of the black produced. After the refractory has cooled during the make cycle, the flow of natural gas to the furnace is stopped and the heating cycle is started again. Heating and make periods are of such length that the desired black is produced. In practice, the timing of the cycles is staggered so that some of the furnaces are always producing black while others are being heated.

Often classified as thermal blacks are acetylene blacks, made by the exothermic decomposition of acetylene at elevated temperatures. These blacks, made principally by Shawinigan in Canada, are used for dry cells and for imparting high electrical and thermal conductivities to rubber.

In general, thermal blacks are not pelletized or compressed because, with the exception of acetylene blacks, they have a density of more than 35 lb. per cu. ft. and do not dust badly. Both FT (fine thermal) and MT (medium thermal blacks) have relatively large particle sizes and do

not reinforce rubber greatly. Relatively low in price, they are easily processed into rubber and are used where high loadings of carbon black are desired, particularly in synthetic rubber.

#### SITUATION TODAY

The statistical picture of the carbon black industry is shown in Fig. 2 for 1935 to 1949, with estimates for 1950 to 1952. The curves emphasize the tremendous growth of the industry during World War II and also point up what is occurring in the competition between the channel and the furnace processes. Channel black production increased substantially during and again immediately after the war, although not at the rate of furnace black increase. Now the channel process appears to be on the down-grade because of low yields, high steel requirements and capital investment, and because of increasing difficulty in securing natural gas supplies.

Channel plant operations depend on having a long-term source of cheap natural gas. In the past, the channel black plants have been able to operate only where an abundant supply of natural gas has been available and they have been driven from their established locations by the encroachment of natural gas pipelines. The effect of gas supplies on the location of channel black plants can be traced by their migration from Pennsylvania to West Virginia, to Louisiana after 1916, and to the Texas-Oklahoma area in the 1920's and 1930's. Now they are being forced to the gas fields in New Mexico and West Texas. With increasing volumes of natural gas being fed into the pipelines, much of the gas available for carbon black manufacture is, and will probably continue to be, diverted to furnace plants which give higher yields of black and require smaller capital investments.

Probably of still more importance is the competition that channel blacks are facing from the newer furnace blacks made from oil. Oil blacks are superior for many uses and are preferred to the channel blacks, even at a slightly higher price.

Before World War II production of furnace blacks was very small compared to that of channel blacks, but today the first type accounts for about 56 percent of all carbon black production. Until the end of World War II, almost all of the furnace blacks were manufactured from natural gas or other naturally gaseous hydrocarbons. Since about 1945, however, the "oil blacks," manufactured from oil rather than from gaseous hydrocarbons, have grown steadily in importance. There were no accurate statistics on the production of oil blacks prior to 1950 but they now account for about 47 percent of all furnace black production and for 26 percent of all carbon black production.

That the importance of all furnace blacks has increased greatly in the last ten years is due largely to the greatly increased use of synthetic rubber during and since World War II. The synthetic rubber industry has stimulated the consumption of furnace blacks for two reasons: (1) With the same loadings of carbon black in rubber, furnace blacks are found to be more satisfactory for many purposes in synthetic rubber than channel blacks. (2) It has been found that much higher loadings of furnace blacks can be used in synthetic rubber than were formerly possible when channel blacks were compounded with natural rubber.

At the close of World War II, when synthetic rubber production in the U.S. was cut back, the rapid increase in the rate of production of gas and oil furnace blacks was slowed down. Although the total consumption of carbon black fell off slightly in 1948 and 1949 from the all-time high reached in 1947, the relative importance of channel and furnace blacks remained unchanged, despite the re-

turn of natural rubber. This shows that the rubber industry can utilize furnace blacks to a considerable extent in natural rubber as well as in the synthetic product.

#### FUTURE TRENDS

With reactivation of the U.S. synthetic rubber industry, production of carbon blacks, particularly of oil and gas furnace blacks, will soon be increased considerably. Production of furnace blacks will probably continue permanently at a high level, relative to channel black production. The principal drawback to furnace black-synthetic rubber combinations has been that in heavy-duty tires for trucks and buses, the heat build-up is excessive and the danger of blow-out is aggravated. Recently, however, compounding practices have been improved and improved synthetic rubbers are being developed which will go a considerable way toward minimizing such failures.

Fig. 6 shows the annual carbon black consumption per ton of rubber consumed since 1935, and the synthetic rubber consumption, expressed as percentages of total rubber consumption. This chart also gives a trend curve of annual carbon black consumption per ton of rubber consumed, plotted against the synthetic rubber consumption, again expressed as percentages of total rubber consumption. These curves indicate that the consumption of carbon black per long ton of rubber has increased as the percentage of synthetic rubber has increased. For the last mentioned curve the points for 1942 and 1943 are well above the curve because relatively small amounts of rubber (either natural or synthetic) were available for consumption and heavier-than-normal loadings of carbon black were used.

As we have seen, the ever-increasing demand for natural gas as a consumer fuel in the northern and eastern portions of the U.S. is an important factor in the carbon black industry. Many pipelines, new and under construction, are fanning out from the Southwest to transport gas to the North and to the East. At present it is extremely difficult to find large gas reserves not already dedicated for pipeline use. It is equally difficult to obtain long-term gas contracts.

Today, erection or relocation of channel plants is generally confined to a few fields in New Mexico and West Texas. However, all processes based on gas, and the channel black process in particular, will suffer an increasingly severe economic disadvantage as the price of natural gas increases. Channel plant yields, based on available carbon, are much lower than those of gas furnace processes, which, in turn, recover less of the available carbon than do oil furnace processes. In general, oil black processes recover from 30 to 60 percent of the available carbon in the oil. This is considerably better than with natural gas in a furnace. Hence, it is believed that, for both economic and technical reasons, the manufacture of oil blacks will assume increasing importance in the carbon black industry, while channel black will become less dominant. However, for special purposes—particularly for color and pigment uses—channel blacks will play a vital part in the industry for many years to come.

In recent years fundamental knowledge of the manufacture and utilization of carbon blacks has increased greatly, resulting in the manufacture of new types of improved carbon blacks for specific purposes. The entire industry is more conscious of technology and specifications and is manufacturing a variety of products for specific purposes. Carbon blacks made from oil are both cause and effect of the trend toward more and better types of carbon blacks. By using aromatic oils as raw materials, new varieties of carbon blacks with reinforcing properties not yet obtainable by use of natural gas are possible. At pres-

ent the oil blacks command the highest prices of any of the rubber-grade carbon blacks, but considerable research and development is under way to develop processes and products based on cheaper oils. There is good reason to believe that processes will be developed which will yield satisfactory blacks from these oils, thus further improving the competitive position of oil blacks.

With the emergence of oil blacks, the geographical limitations on carbon black manufacture have been removed and only economic limitations remain. Sometimes rail freight charges on carbon black may be greater than the difference in delivered cost of the equivalent oil to a furnace plant at a rubber processing center, as compared with the delivered cost of oil at one of the traditional carbon black manufacturing centers in the Southwest. In such cases, the carbon black plant might be located near rubber processing plants in a rubber center such as Akron.

One oil black plant is already in operation in England and another is scheduled for early 1951, again indicating the growing independence of the carbon black industry from natural gas. Although an annual production of 40,500,000 lb. of oil blacks in England will largely supply the English carbon black market, this production will amount to less than 15 percent of total U.S. exports. Until foreign manufacture of carbon blacks is increased considerably, it will not greatly affect the U.S. industry.

At a number of synthetic rubber plants, carbon black is incorporated in the latex prior to coagulation. The mixture of synthetic rubber and carbon black is then shipped to the tire manufacturer or rubber processor. This process, called masterbatching, effects a considerable saving in the power required to mill the dry pigment into the dry rubber at the tire factory. It suggests that in the future carbon black plants, using oil, may be located near the synthetic rubber plants.

As the profit margin in the manufacture of gas furnace blacks is narrowed, and as the relatively more expensive oil furnace processes are used to a greater extent, better recovery of carbon black from flue gases becomes more important. At present, the electrostatic precipitator and two-stage cyclone combination recovers only about 90 percent of the carbon black from the flue gases. To increase the recovery of black from 90 to 99+ percent, it is necessary to use a secondary collector such as a combination precipitator-scrubber, a wet scrubber, or a bag filter. Although these devices are relatively expensive to build and to operate, they are gaining ready acceptance by the industry on both economic and smoke abatement grounds.

When the carbon black industry was located largely in the wide open spaces of the Southwest, air pollution was generally no problem. But as the industry becomes free of its geographical dependence on natural gas fields and tends toward oil, plant sites near refineries—generally near cities—become more attractive. Thus, the problem of smoke abatement becomes more acute and essentially complete clean-up of stack gases takes on greater importance. For these various reasons all new carbon black plants located near cities within the next few years will probably have recovery efficiencies greater than 99 percent.

A new development affecting collection of furnace blacks is the sonic agglomerator. Until recently, the only type of agglomerator considered for use in the carbon black industry was the electrostatic precipitator. Now, however, after extensive pilot plant tests, the sonic method will be used in a commercial SRF plant under construction by Continental Carbon Co. The finely dispersed carbon black will thus be agglomerated into particles large enough for removal from the flue gases by subsequent multistage cyclonic collection.

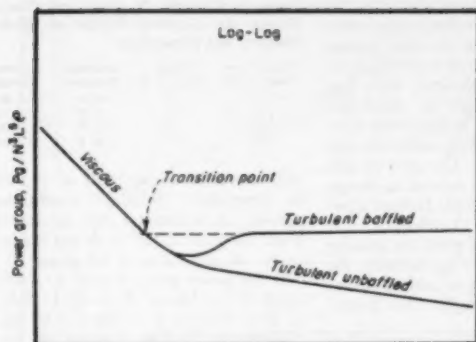


Fig. 1—Power relation to other variables follows this pattern.

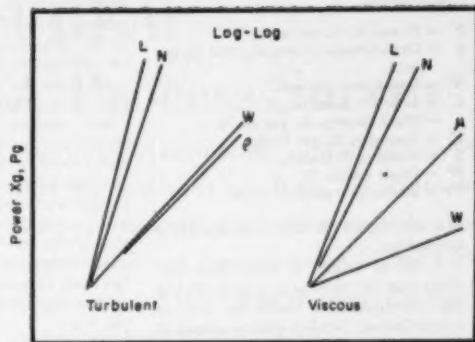


Fig. 2—How system variables react on power used by agitator.

## How to Estimate Agitator Power From Blade Dimensions

For simple turbine-type agitators, the power requirements in baffled tanks can be estimated from the number and dimensions of the blades, knowing speed and fluid properties.

### D. E. MACK

Agitator performance, as is now well known, is related intimately with the power consumption of the impeller. This means that power requirements in agitation are basic to any study of agitator performance. In this paper and an earlier, somewhat similar one<sup>1</sup> the question of predetermining agitator power from its design and dimensions has been considered, using equations developed by O'Connell.<sup>2</sup>

Relations between agitator power and the several other pertinent variables of the system have been discussed by such investigators as White,<sup>3</sup> Hixson<sup>4</sup> and Rushton,<sup>4</sup> whose results follow the pattern of Fig. 1. However, such a plot is specific to a particular geometric configuration of the turbine, holding for all members of that geometric series. The present paper shows how these relations change as the geometric configuration of the turbine changes.

O'Connell<sup>2</sup> studied what he called "simple" turbines which had two, four

and six blades perpendicular to the shaft, and no hubs. The variables were blade length and width. He chose this type of turbine as a basic form, rather than as a match for any existing commercial type. The studies produced equations in both the turbulent region (baffled) and the viscous region, for two, four and six bladed turbines, which can be generalized for S blades as:

Turbulent region baffled:

$$\frac{P_g}{N^3 L^5 \rho} = 9.745^{0.495} \left( \frac{W}{L} \right)^{1.335^{0.106}} \quad (1)$$

and for the viscous region:

$$\frac{P_g}{N^3 L^5 \rho} = 90.05^{0.387} \left( \frac{W}{L} \right)^{0.835^{0.280}} \quad (2)$$

where  $(N L^2 \rho / \mu)$  is a modified Reynolds number and  $(P_g / N^3 L^5 \rho)$  is similar to a friction factor which will be referred to as the "power group."

Fig. 2 displays graphically the effect of these several variables on the power.

It is desirable to find the relationship between the equations for streamline flow and those for turbulent flow. If we extend the line for turbulent flow to the left in Fig. 1 it will intersect (dotted portion) the line for vis-

cous flow at some point which can be defined as the "transition point". This point is important since it shows where the transition from viscous to turbulent flow may start, although it does not indicate where the change may end. It is of more value as a construction point, since if it is known, both the viscous and turbulent parts of the curve may easily be drawn in. This point can be determined by solving pairs of equations, one for turbulent flow and the corresponding one for viscous flow.

#### FINDING TRANSITION POINT

For the turbines under study, the point is a function only of the width-length ratio of the blades and the number of blades. The following equations may be used for computing the point:

$$\left( \frac{N L^2 \rho}{\mu} \right)_T = 9.255^{0.088} \left( \frac{W}{L} \right)^{0.71} \quad (3)$$

$$\left( \frac{P_g}{N^3 L^5 \rho} \right)_T = 9.745^{0.495} \left( \frac{W}{L} \right)^{(0.71 + 0.835^{0.280})} \quad (4)$$

If we impose reasonable limits on  $L/W$  and on  $S$ , we may find the maximum spread of values of the Reynolds number and power group. These val-

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# Nomenclature

$P$	= Power, ft.-lb. per sec.
$g$	= Gravitational constant, 32.2 ft. per sec. <sup>2</sup>
$N$	= Speed, rev. per sec.
$L$	= Impeller diameter, ft.
$\rho$	= Fluid density, lb. per cu. ft.
$\mu$	= Viscosity, lb. per ft.-sec.
$S$	= Number of blades.
$W$	= Blade width, ft.
$Tr$	= Refers to transition point.

ues are shown in the accompanying tabulation.

A set of values of these four variables may be plotted as a grid on log-log coordinates to make for ease of computation. Such a grid is shown in Fig. 3. To use the grid, a point is found corresponding to an  $L/W$  ratio and the number of blades. From this point a line is drawn at 45 deg. upwards and to the left. This is the viscous region. Then from the point a line is drawn horizontally and to the right. This line gives the turbulent region so long as the Reynolds number is maintained above 10,000. Between  $Re = 10,000$  and the transition point a dip in the curve exists (transition range) which cannot be anticipated by this plot.

This dip may be only slight, or it may go down to a value as low as 50 percent of the final value of the power group in the turbulent region. Rushton<sup>4</sup> has shown that flat-blade turbines seem to have a greater dip than other types, such as curved blades. Hence a smooth dip in the curve extending from the transition point to  $Re =$

10,000, and descending to about 50 percent of the final value, might serve as an approximation for this region for turbines of the type reported here.

It must be emphasized that this plot is for what might be called the "basic" turbine and is applicable only for the viscous and fully baffled turbulent modes of flow. The plot should give the information needed to design paddles and other simple turbine types with considerable confidence. It should also serve as a guide for making modifications of existing turbines, for example, eliminating or adding blades or reducing blade length. (See Example 3.)

The plot also furnishes a convenient reference from which deviations may be made when studying commercial turbines which do not have the same geometry as those studied. Its values hold fairly well in the viscous region for several other open turbine types, namely, the flat-blade, curved-blade and arrowhead dispersers and fan turbine reported by Rushton. In the viscous region these values might be used for types not reported in the literature.

As examples of the utility of the plot, consider the following three problems:

**Example 1**—A four-blade turbine with a diameter of 12 in. and a blade width of 2 in. is running in a baffled tank of water at 120 rpm. What is its power consumption? Here  $L/W = 12/2 = 6$  and  $Re = NL^2 \rho / \mu = (120/60) \times 1 \times 62.4 \div 0.000672 = 185,700$ . This Reynolds number is

# Range of Reynolds Numbers and Power Groups for Limiting Values of Blade Numbers and Dimensions

Dimension Ratio, $L/W$	Blade Number, $S$	Reynolds Number	Power Group
2	3	13.4	5.86
2	10	9.5	18.70
10	2	43.0	0.82
10	16	29.5	3.74

well above the upper limit of 10,000 so completely turbulent conditions prevail. A horizontal line is drawn from the point  $L/W = 6$  and blades = 4. At any value of  $Re$  above 10,000 the power group  $P g / N^3 L^5 \rho$  will equal 2.50. Hence  $P = (2.5/32.2) \times 2^3 \times 1^3 \times 62.4 \div 550 = 0.07$  hp.

**Example 2**—The turbine of Example (1) is to be run at 60 rpm. in a viscous oil of specific gravity 1.00 and viscosity 5,000 centipoises. Now what will its power consumption be? Here  $Re = (60/60) \times 1 \times 62.4 \div 1.00 \div (0.000672 \times 5,000) = 18.6$ . Since this is below the critical Reynolds number, the flow will be viscous, along a line drawn upward and to the left at 45 deg. from the transition point. At  $Re = 18.6$  the value of the power group will be 3.50, so  $P = (3.5/32.2) \times 1^3 \times 1^3 \times 62.4 \div 550 = 0.012$  hp.

**Example 3**—An eight-blade turbine with a  $W/L$  ratio of 8.0 is to be changed to four blades to reduce its power requirements. What will be the power reduction in (a) the turbulent and (b) the viscous region? Assume that the effect of the number of blades is the same for any type of turbine. In the turbulent region the value of the power group for four blades is 18, and for eight blades, 31, so that the power ratio for a four- to an eight-blade turbine is  $18/31 = 58$  percent, or a reduction of 42 percent in the modified turbine.

In the viscous region, at some low Reynolds number such as  $Re = 20$ , the power group value for four blades is 30, and for eight blades is 45, so the power ratio for a four- to an eight-blade turbine is  $30/45 = 67$  percent, or a reduction of 33 percent for the modified turbine. For flat-blade dispersers Rushton's data also show a 42 percent reduction in the turbulent region for a similar turbine change. Unfortunately data are not available to check the reduction found for the viscous region.

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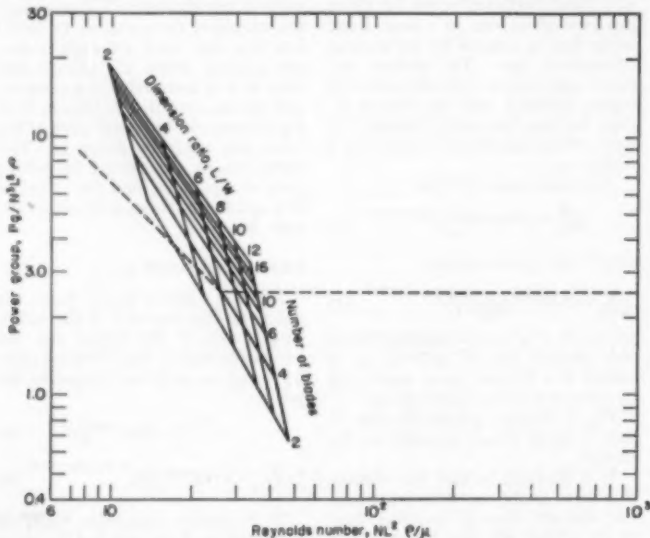
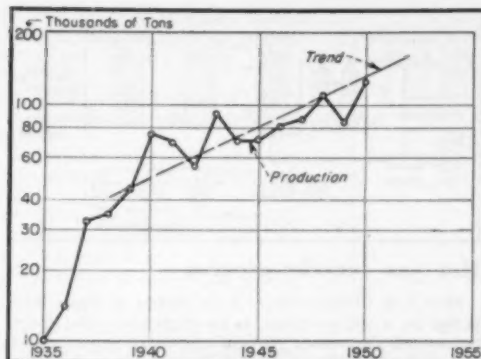


Fig. 3—Plot for estimating power requirements for turbine-type agitators. Location of the curve depends on ratio of blade length to width, and number of blades.





#### AUGUSTE ROOSEBOOM

The synthesis of urea from ammonium cyanate by Wohler in 1828 marked the first time that a substance produced in life had been prepared in the laboratory. Since Wohler's classical work, many methods of urea synthesis have been suggested. It has been made on a very small commercial scale by hydrolysis of calcium cyanamide under pressure. Large scale manufacture in modern times, however, has been based on synthesis from ammonia and carbon dioxide. Even this process is fairly old, dating back to 1868.

Many efforts at commercial production have ended in failure because of the high cost of ammonia, corrosion problems, and other difficulties. First successful operations were at the Oppau plant in Germany. In about 1933 Du Pont began production in the United States in conjunction with its ammonia plant at Belle, W. Va., and remained the only domestic producer until last year. A new Solvay plant at South Point, Ohio, is now in operation, and new plants are under consideration by several other ammonia manufacturers.

Domestic production of urea<sup>a</sup> is shown in the chart above. Price has varied from \$95 per ton over the period 1935-1939 to a low of \$60 in 1945. Current quoted price is \$110. Uses and trend of the market have been treated in several technical publications.<sup>1,2,3,4,5</sup> The accompanying table summarizes the more important uses. More rapid expansion of markets is hampered by the present un-

#### USES OF UREA

**In Plastics**—Urea-formaldehyde molding compounds, adhesives, coatings, leather tanning agents, textile anti-shrink compounds, ion exchange resins. Competitive position: Cheaper than phenol-formaldehyde resins, colorless; but lack high water resistance.

**In Agriculture**—Solid fertilizers, spray fertilizers, ammoniating agent, cattle feed. Competitive position: High nitrogen content (46 percent), easily assimilated by animals and plant leaves, no fire or explosion hazards; but not as suitable as ammonia salts for certain crops under certain conditions.

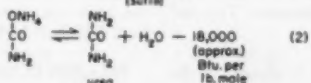
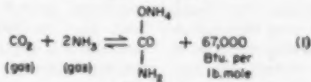
**In Chemicals**—Intermediate for ammonium sulphamate, sulphamic acid, phthalocyanine pigments, pharmaceuticals.

**In Specialties**—Ammoniated toothpaste, deodorant creams, solder flux, foam rubber blowing agent.

favorable balance between supply and demand.

#### BASIC CHEMISTRY

The commercial process in current use is based on two reactions:



Both reactions are reversible; equilibrium depends, therefore, on temperature, pressure, and concentration of the various components.

Solid ammonium carbamate has a dissociation pressure of about 1 atm. at 60 deg. C. This pressure rises

## UREA: A Process Survey

Practical and theoretical considerations behind urea production. Why, for example, must you operate the reactor at high pressures? What are the economics of the various processes? How does the new Pechiney process compare?

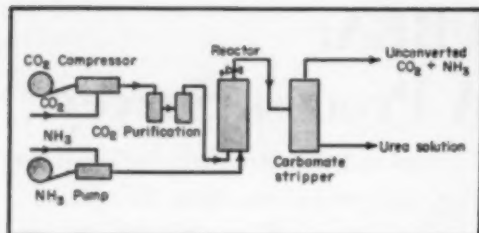
quickly with increase of temperature and is approximately 7 atm. at 100 deg. C. At pressures higher than the corresponding dissociation pressures, carbamate is readily formed, with substantial liberation of heat. On the other hand, with increase of temperature or reduction of pressure below dissociation pressure, the carbamate will rapidly decompose into its gaseous components.

Reaction (2), the conversion of carbamate into urea and water, is somewhat endothermic. This reaction takes place only in the liquid or solid phase and is subject to equilibrium, the presence of water having a tendency to reverse the reaction.

An elaborate study of the formation of urea from  $\text{CO}_2$  and  $\text{NH}_3$  was made by M. Frejaques.<sup>6</sup> The graph on page 113 is reproduced with his permission. It gives the varying ratio of transformation of  $\text{CO}_2$  into urea with varying amounts of  $\text{NH}_3$  and  $\text{H}_2\text{O}$  present and at various temperatures. It is evident from this graph that increase of temperature raises the conversion ratio. It would seem advantageous, therefore, to operate at high temperatures. However, as the formation of urea proceeds only in the liquid or solid phase, it is necessary to maintain the liquid phase by pressure. Inasmuch as pressure rapidly increases with rising temperatures, reaction temperatures over 210 deg. C., corresponding to a conversion ratio of about 0.55, are seldom exceeded in practice.

Formation of urea and water from  $\text{CO}_2$  and  $\text{NH}_3$  by the combined reactions of (1) and (2) is highly exothermic. Hence, for the continuous performance of the reaction some form of cooling is always necessary, even when the  $\text{NH}_3$  is introduced in liquid form. This point is quite important from the standpoint of process design, as will be evident in further discussion.

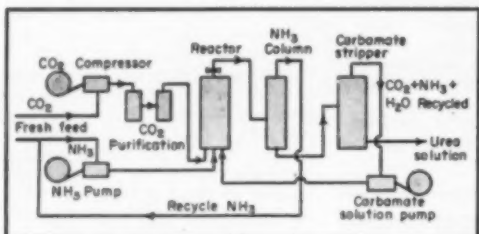
DR. ROOSEBOOM, a chemical consultant, is vice president of Chemical Research Associates, Bernardsville, N. J. He has had wide experience both in this country and abroad, especially in chemical derivatives of petroleum and natural gas.



### Once-through process

**PROCESS CONDITIONS:** Compressed  $\text{CO}_2$  and liquid  $\text{NH}_3$  are fed in a constant molar ratio of 1  $\text{CO}_2$  to 2 or more  $\text{NH}_3$ . The reactor operates at 150-200 atm. pressure and is controlled at 160-180 deg. C. The liquid reaction mass goes from the reactor to a flash stripper at somewhat over atmospheric pressure. Here the carbamate rapidly dissociates into  $\text{NH}_3$  and  $\text{CO}_2$ , resulting in a reduction of temperature to about 95 deg. C. The resulting  $\text{NH}_3$  and  $\text{CO}_2$  are stripped from the urea solution and leave the system, usually serving as feed material for a subsequent operation in which  $\text{NH}_3$  is recovered.

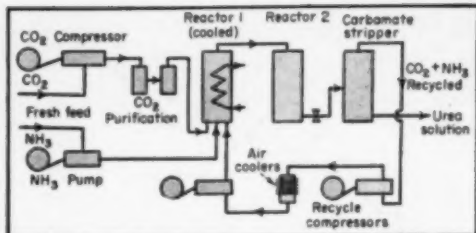
**PROCESS ECONOMICS:** Depending on the operating conditions selected, the conversion of carbon dioxide and ammonia to urea will vary from 30 to 60 percent. The yield, calculated on gases actually consumed in the process, should be close to theoretical; losses are limited to small amounts of ammonia entrained in the urea solution. Recovery of ammonia in some form, such as the sulphate or nitrate, is an economic necessity. Corrosive conditions make it necessary to use lead lining for the reactor system.



### Solution recycle process

**PROCESS CONDITIONS:** Recycling of ammonia and carbon dioxide as an aqueous solution of ammonium carbamate tends to reduce the conversion because of the presence of so much water in the system. Du Pont compensates by using high reactor temperatures (200-210 deg. C.) and by maintaining an excess of 3.5 moles of  $\text{NH}_3$ . These conditions require, in turn, very high reactor pressures (about 400 atm.). Because of the high excess  $\text{NH}_3$  in the system, it is possible to strip most of it away from the reaction solution and recycle it as liquid ammonia. This provides additional self-cooling in the reactor.

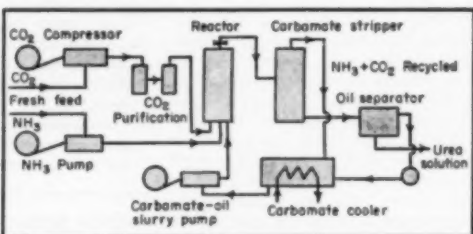
**PROCESS ECONOMICS:** Over-all yield is reported to be about 91 percent on ammonia and 81 percent on carbon dioxide. A conversion per pass of 70 percent on  $\text{CO}_2$  (compared with normal 40-45 percent at 170 deg. C.) reduces compression requirements somewhat. Plant investment is high because of the high operating pressure and the necessity for using silver-lined reaction equipment. Higher temperature increases the corrosion problems; in spite of the silver-lined equipment, it seems that corrosion troubles have been experienced.



### Hot gas recycle process

**PROCESS CONDITIONS:** I. G. Farben at Oppau compressed the recycle gas mixture in five stages up to 120-130 atm. in uncooled compressors. Between compression stages air cooling was provided; this, however, had to be very carefully controlled so that solid carbamate would not be formed. Recycle of hot gases imposed a greater cooling load on the reaction system than would be the case when feeding cold  $\text{CO}_2$  and liquid  $\text{NH}_3$ , and required the use of a two-stage reactor to control the reaction at the desired temperature of 160-170 deg. C. Heat was carried off by water boiling inside the tubes under regulated pressure.

**PROCESS ECONOMICS:** Over-all yield of urea was reported to be 93 percent on ammonia and 83.5 percent on carbon dioxide. The first reactor stage was packed with a multiplicity of lead-covered cooling tubes. The recycle compression system also contributed to an obviously high plant investment. Operation of this plant was difficult and required an exorbitant maintenance. This process may now be considered as outdated and cannot be recommended for industrial practice in competition with other processes.



### Oil slurry recycle process

**PROCESS CONDITIONS:** The recycle gas stream is conducted under a pressure of a few atmospheres to internally cooled and agitated vessels, through which mineral oil is circulated. Here the  $\text{NH}_3$  and  $\text{CO}_2$  readily condense to solid carbamate which is dispersed in the oil. This crystal slurry (temperature not higher than 45 deg. C.) is then pumped into the reactor, which operates at 180 deg. C. and 200 atm. pressure. Apart from its function as carrying vehicle for the carbamate, the oil also helps control the reactor temperature by taking up liberated heat. This heat is partially released in the stripper.

**PROCESS ECONOMICS:** A yield of about 93 percent on both  $\text{NH}_3$  and  $\text{CO}_2$  is claimed, without purge recovery and with a  $\text{CO}_2$  feed of 98 percent purity. With a  $\text{CO}_2$  purity of 99.5 percent, yield may go up to better than 96 percent on  $\text{NH}_3$ . Corrosive conditions (high temperature) occur only in the reactor, which is a lead-lined shell without any internal cooling device. The presence of oil tends to reduce corrosion; with due elimination of oxygen from the  $\text{CO}_2$  feed, corrosion of any kind is at a minimum.

## COMMERCIAL MANUFACTURE

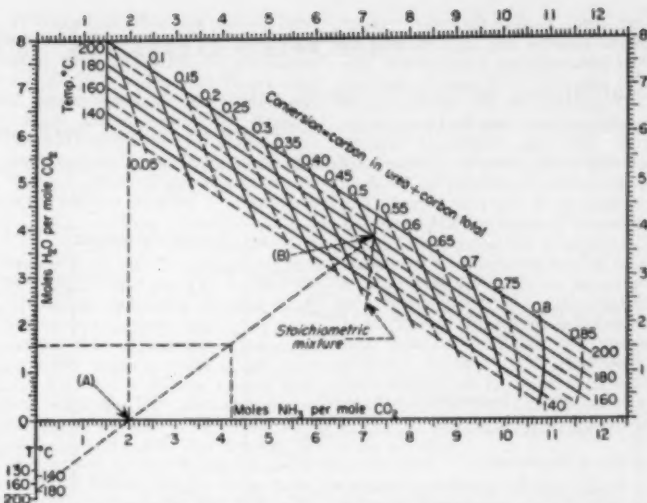
In principle, commercial production of urea is based on the following steps:

1. Compression of  $\text{CO}_2$ .
2. Compression and liquefaction of  $\text{NH}_3$ .
3. Introduction of  $\text{CO}_2$  and  $\text{NH}_3$  under pressure into the reaction system.
4. Release of pressure and decomposition of unconverted carbamate into  $\text{NH}_3$  and  $\text{CO}_2$ .
5. Recovery of urea in marketable form.

Purification of  $\text{CO}_2$  is required to remove all traces of sulphur compounds and oxygen. This is usually accomplished by running the compressed  $\text{CO}_2$  through two pressure chambers in series. In the first chamber sulphur compounds are adsorbed by activated carbon, and in the second chamber free oxygen is removed by a copper catalyst. If oxygen is present in the reaction mixture in only trace quantities, severe corrosion problems are encountered. It is therefore of particular importance that all traces of oxygen be removed.

The  $\text{CO}_2$  stream should preferably be as low as possible in inert gas content, as the presence of inert gases will necessitate higher pressure in the reactor. If the process involves the recycling of recovered  $\text{NH}_3$  and  $\text{CO}_2$ , moreover, it is necessary to purge continuously a certain portion of the gases in order to eliminate excess inert gases which otherwise would continue to build up in the system. Purging will entail a loss of  $\text{NH}_3$  and  $\text{CO}_2$ , increasing with the amount of inert gas to be eliminated. This is another reason why it is desirable to use a  $\text{CO}_2$  feed with the smallest possible amount of inerts present. For large installations it might pay to recover  $\text{NH}_3$  from purge gas by absorption in an acid medium. If, however, you can start with a  $\text{CO}_2$  feed gas of not less than 99 percent purity (as obtained, for instance, from Girbotol installations), losses in purge gas are so small that recovery is not necessary.

Compressed  $\text{CO}_2$  and liquid  $\text{NH}_3$  are introduced into the reactor in a molar ratio of 1  $\text{CO}_2$  to 2 or more  $\text{NH}_3$ . The reactor must be provided with cooling means sufficient to maintain the reaction temperature at the desired level. Under favorable conditions sufficient cooling may be obtained merely by cooling the reactor wall, but sometimes it may be necessary to provide internal cooling tubes in the reactor. Corrosive conditions in the reactor require use of lead, or, under severe conditions, silver.



CHEMICAL EQUILIBRIUM considerations in urea synthesis are illustrated in this graph, the result of a study by Frejaques<sup>1</sup>. You can see that starting with a stoichiometric mixture of  $\text{CO}_2$  and  $\text{NH}_3$  in the absence of water, represented by point A, a conversion of 0.50 is obtained at a temperature of approximately 180 deg. C. (point B). It is evident that the initial presence of water has a strongly depressing influence on the conversion ratio. Excess  $\text{NH}_3$  over the theoretical 2 moles per mole of  $\text{CO}_2$  causes an increase of the conversion ratio calculated on  $\text{CO}_2$ , but, of course, a reduced conversion calculated

on  $\text{NH}_3$ . On the other hand, excess  $\text{CO}_2$  has a much smaller influence on the conversion ratio calculated on  $\text{NH}_3$ . Reaction temperature has considerable influence not only on the conversion ratio but also on the rate of reaction. Rate of reaction becomes noticeable at about 130 deg. C. and increases rapidly with temperature. At temperatures of about 170 deg. C. equilibrium is practically reached (in liquid phase) within 20 min. Although it is theoretically possible to increase the reaction rate by use of certain catalysts (e. g., aluminum silicate), in practice the rate is sufficiently high to make catalysts unnecessary.

The liquid reaction mass (containing urea, carbamate and water) leaves the reactor via a pressure reducing valve and enters a flash stripper. Here the carbamate rapidly dissociates into  $\text{NH}_3$  and  $\text{CO}_2$ ; these gases are then stripped from the urea solution.

The hot solution usually has a urea concentration of about 75 percent. It may be used without further purification for making so-called urea-ammonia liquors by mixing it with ammonia and possibly some other salts in varying proportion. Solid urea fertilizer is made by spray drying the hot concentrated solution.

## PURIFICATION OF CRUDE

Crude urea solution will always contain some biuret, formed by reaction of urea in solution at temperatures of 100 deg. C. or greater. The higher the temperature and the longer the time of exposure, the more biuret will be formed. In order to keep the biuret content as low as possible, it is desirable to work up the hot urea solution in the least possible elapsed time.

This is not very important when manufacturing fertilizer urea, but for the production of technically pure urea, biuret content of the solution should be as low as possible. With good control it may be kept between 1 and 2 percent. The urea solution will also contain traces of iron and possibly other heavy metal salts, such as chromium and nickel.

For making pure urea, the solution is purified by such means as aeration and treatment with activated carbon. The purified solution is then further concentrated by evaporation (for instance, in a Kestner evaporator) and crystallized. The crystal slurry is separated from the mother liquor by filtration or centrifuging and dried in a rotary dryer, giving the final technically pure product. These operations are done in aluminum or stainless steel equipment.

Mother liquor may be recirculated until the biuret concentration has built up to such extent that the mother liquor must be discarded. It may be dried and sold as crude ferti-

lizer urea. Technically pure product should contain not more than about 0.05 percent biuret, less than 0.01 percent ash, and 1 to 2 percent moisture.

Depending on the conditions of operation, the component gases recovered from the carbamate stripper amount to at least 40 percent, and under certain conditions up to about 70 percent, of the reactor feed. This recovered mixture of  $\text{NH}_3$  and  $\text{CO}_2$  (and more or less water vapor) can be used as feed material for a subsequent operation in which the  $\text{NH}_3$  value is utilized, such as in the manufacture of ammonium sulphate or nitrate by reacting with sulphuric or nitric acid, respectively. This type of operation may be indicated as the once-through process. Solvay's new plant is believed to be using this process.

#### RECYCLE PROCESSES

Apart from the question of whether or not there is opportunity or need for the reclamation of unconverted  $\text{NH}_3$  as ammonium sulphate or nitrate, it may, generally speaking, be more economical to convert practically all ammonia (and  $\text{CO}_2$ ) into urea by recycle of the recovered gas mixture. However, here at once a specific problem imposes itself. When recompressing a mixture of  $\text{NH}_3$  and  $\text{CO}_2$  to reactor pressure, solid carbamate will form immediately, making such recompression in a normal manner technically impossible. There are four known methods of circumventing this obstacle:

1.  $\text{NH}_3$  and  $\text{CO}_2$  may be separated by chemical or physical means, and the individual gases may then be recycled together with the fresh feed. This method has never been used in industrial practice because it is too costly.

2. Recompression of the mixed gases may be at a temperature level higher than the temperature of dissociation at prevailing pressures. This method has been applied by I. G. Farben in their Oppau plant.<sup>4</sup>

3.  $\text{CO}_2$  and  $\text{NH}_3$  may be recycled in watery solution. The recycling of ammonium carbamate in water has been described in U. S. patents<sup>5</sup> assigned to Du Pont and is presumably the process employed at Belle.

4.  $\text{CO}_2$  and  $\text{NH}_3$  may be recycled as a finely divided slurry of carbamate in a neutral liquid medium. The method of recycling  $\text{NH}_3$  and  $\text{CO}_2$  in the form of a carbamate slurry suspended in a mineral oil was developed by Pechiney in France.

The once-through process and the three commercially used recycle processes are described and compared on p. 112. You can see why I. G. Far-

ben's process was difficult to operate and costly to maintain and is now considered obsolete. The other processes are all competitive under certain conditions. The Pechiney process is available for license in this country and Canada through Foster-Wheeler. Several prospective producers are said to be considering Pechiney type installations.

#### OVER-ALL PROCESS ECONOMICS

Theoretically, 57 lb. of  $\text{NH}_3$  and 73.5 lb. of  $\text{CO}_2$  are required per 100 lb. of urea. As ammonia is by far the most costly raw material, commercial operation is directed in such manner that the highest possible efficiency with respect to  $\text{NH}_3$  is obtained. For recycle processes,  $\text{NH}_3$  efficiency runs from about 90 percent to as high as 98 percent and  $\text{CO}_2$  efficiency from about 80 percent to 95 percent, depending on type of process, purity of  $\text{CO}_2$  feed, etc. It can be said that industrially about 60 lb. of  $\text{NH}_3$  and 80 to 90 lb. of  $\text{CO}_2$  are required per 100 lb. of crystal urea (technically pure quality).

Urea manufacture becomes economically attractive in locations where carbon dioxide in sufficient concentration is available as a waste product from other operations. This is particularly the case at synthetic ammonia plants which obtain their hydrogen by conversion of natural gas with steam. The  $\text{CO}_2$  which is removed by means of Girbitol or similar processes can be recovered in high purity and abundant quantity. In case water gas from coke is used as the hydrogen source, there is also a  $\text{CO}_2$  stream available; but it usually requires further concentration and results in a higher cost for plant investment and operation.

#### PLANT INVESTMENT

The minimum economic size of plant for the manufacture of urea under American conditions is usually considered to be about 50 tons of urea per 24-hr. day. Capacities of about 100 to 120 tons per day are somewhat more economical. Still higher capacities will require duplication of equipment and will not materially influence the economics of investment and plant operation.

Under present conditions it may be roughly estimated that for a plant with a capacity on the order of 100 tons urea per day, built adjacent to an existing ammonia plant, investment will be between \$12,000 and \$20,000 per daily ton. Variations within this range will depend on the purity of available  $\text{CO}_2$ , the type of process, and the type of product (agricultural urea

vs. technically pure). Generally speaking, recycle operation will require somewhat higher plant investment than once-through operation, although when using the Pechiney process this difference will be rather small.

Ammonia is by far the most important cost item, and comparatively small differences of a few percent in yield reflect in the cost of urea. Under favorable conditions the cost of  $\text{CO}_2$  is practically nil. Cost of auxiliary materials (for purification of feed and product, etc.) is quite low—usually less than \$1 per ton of product.

#### OPERATING COSTS

As usual with large scale continuous processes, operating labor is not a very large cost item. A crew of about six or seven men per shift will generally suffice.

Maintenance costs were very high for such processes as practiced by the Germans in Oppau, where a great deal of corrosion trouble could not be avoided. However, when employing a modern process like Pechiney's, corrosion can be eliminated almost completely by careful operation. In such cases maintenance cost will be of the same order as in ammonia plants—say 3 to 5 percent yearly on plant investment.

Requirements for steam (mainly for drying of product) and cooling water are not excessive and may be taken to be about \$2-\$3 per ton of urea. A rather important cost item is the over-all energy required for  $\text{CO}_2$  compressors, pumps, etc. Depending on the choice of process this may vary between a minimum of about 220 kwh. to some 500 or more kwh. per ton of product.

When taking as an example the low cost oil slurry recycle process, over-all operating and maintenance cost (exclusive of raw material) may be estimated at approximately \$11 per ton of urea. Assuming the cost of ammonia at \$80 per ton and carbon dioxide at no cost, raw material cost will amount to about \$48 per ton of urea; this brings the over-all cost of the product up to approximately \$59 per ton, exclusive of amortization of plant investment.

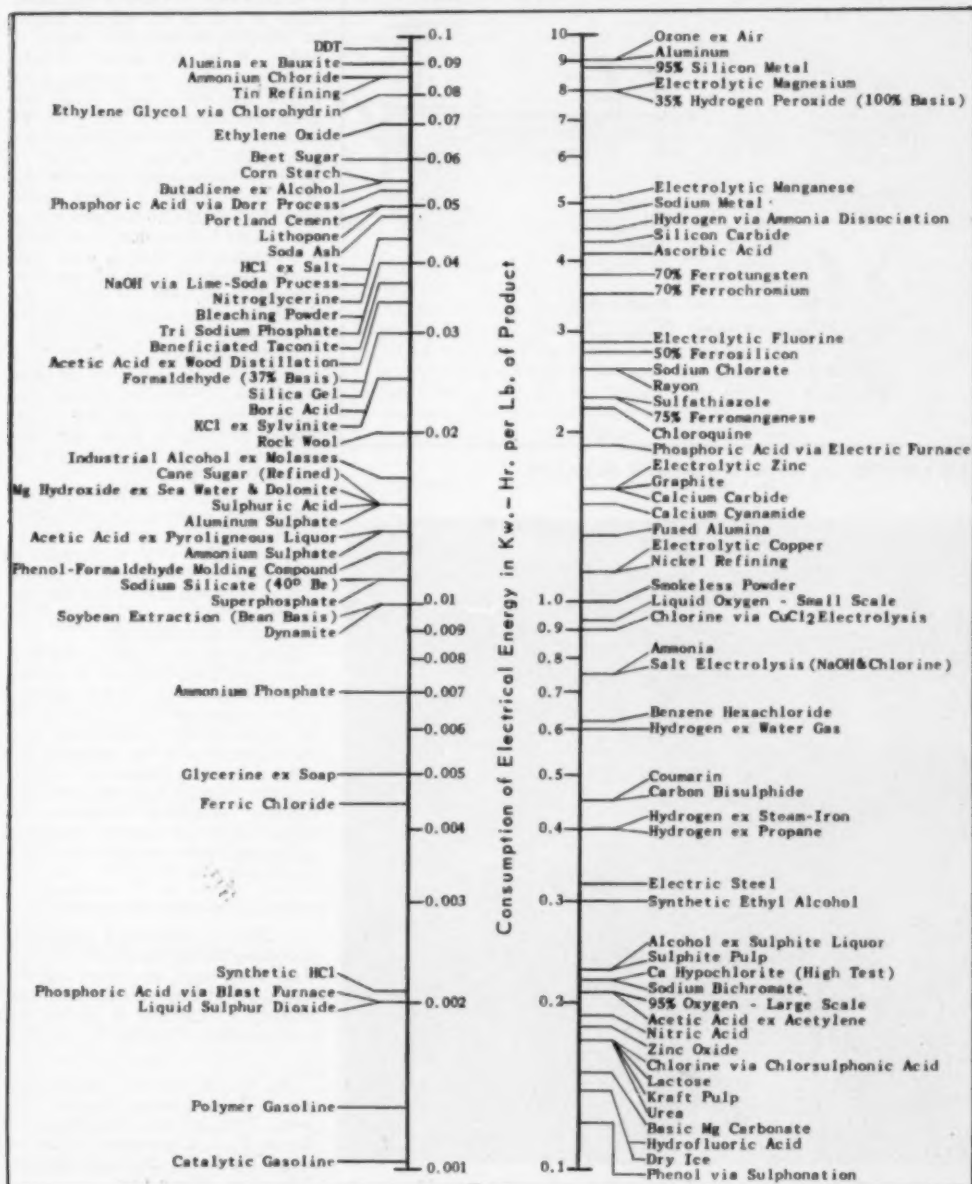
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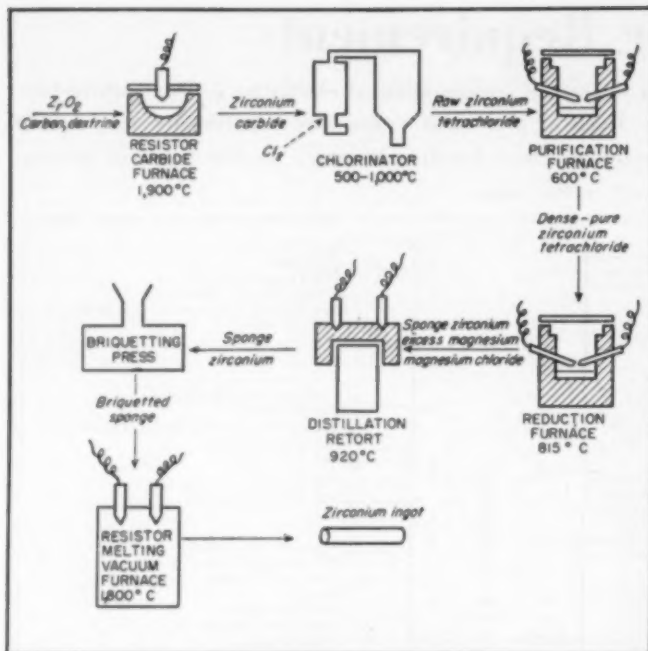


# Process Power Requirements

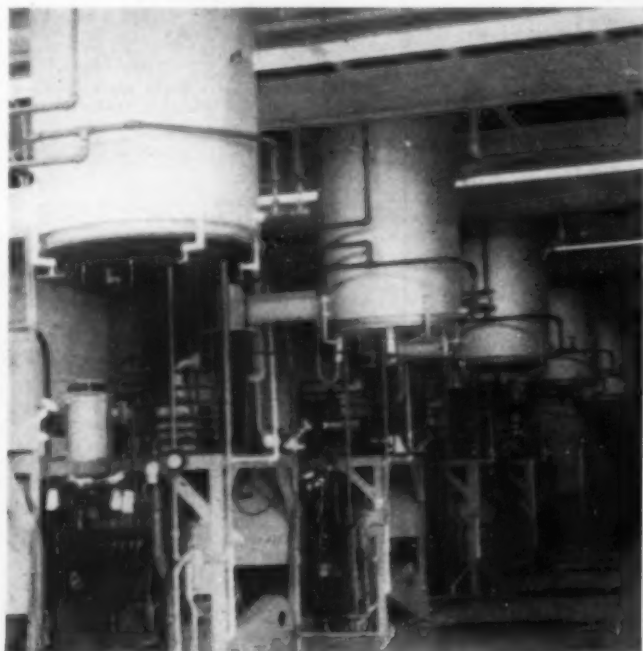
This chart gives you unit figures on consumption of electricity in the manufacture of over 100 chemical products. Much of this information was supplied by cooperating industry representatives and is published here for the first time. Similar charts on process steam and water requirements will follow soon.







NEW PROCESS turns out ductile zirconium in ton quantities.



Salt and excess magnesium removed by heating in high vacuum. Salt melts; Mg vaporizes.

## Ductile Zirconium

W. W. STEPHENS  
J. H. McCLAIN

It isn't easy to refine a rare metal when as little as 0.2 percent oxygen or nitrogen contamination makes it useless. If this fact weren't enough, molten zirconium, like titanium, is an almost universal solvent which dissolves most refractories. But given the combination of brains and money most technological barriers fall sooner or later. This time it was sooner for the sharp U. S. Bureau of Mines. Brains were W. J. Kroll who has been testing the process he invented, since 1948, and Stephen M. Shelton who, with bureau personnel, designed and constructed a new \$325,000 plant at the Northwest Electrodevelopment Lab., U. S. Bureau of Mines, Albany, Ore.

Production figures are 7,000 lb. a month—all going to government-sponsored projects. Demand continues way ahead of supply and right now an additional \$100,000 is being spent for new units to increase production capacity to over 10,000 lb.

Process consists essentially of reducing zirconium tetrachloride with molten magnesium. At present, it is a batch-type operation with production of approximately 150 lb. of zirconium sponge per batch from a raw chloride charge of 420 lb. and using 100 lb. of magnesium for reduction.

Equipment and layout in the new plant have been designed to permit easy modification to a system whereby gaseous zirconium tetrachloride would be passed through a heated pipe from the purification to the reduction furnace and molten magnesium chloride would be tapped from the reduction crucible, permitting production of larger batches of metal in the same equipment with reduced labor and equipment costs.

### ZIRCONIUM CARBIDE PRODUCTION

Consists of smelting a mixture of zirconium-bearing concentrate (zircon from beach sands, or zirkite) and carbon in a single-phase arc furnace. More recently by treatment of purified zirconium oxide and carbon in a graphite

W. W. STEPHENS is a metallurgist and J. H. McCLAIN a chemical engineer. Both are with the Bureau of Mines, U. S. Department of the Interior, Northwest Electrodevelopment Laboratory, Albany, Ore.

resistor furnace at about 1,900 deg. C.

Chlorination is in an internally heated shaft furnace by passing chlorine gas through a charge of carbide dispersed with coke. Reaction proceeds at 500 deg. C. to 1,000 deg. C. Zirconium tetrachloride is collected in a condenser maintained at a temperature ranging from 100 deg. C. to 300 deg. C. Silicon and titanium tetrachlorides in chlorination pass through the condenser to a scrubbing tower to waste.

#### PURIFICATION OF CRUDE CHLORIDE

In the reduction step, the dense, pure chloride is resublimed from the cooling coils over a mild steel crucible containing molten magnesium at about 825 deg. C. Resulting product is a mixture of zirconium sponge, magnesium chloride, excess magnesium.

#### SALT REMOVAL

Magnesium chloride and excess magnesium are removed by vacuum distillation. Major portion of the magnesium chloride melts and drains away, leaving the cake of zirconium sponge in the reduction crucible. Excess magnesium and the remaining magnesium chloride distill to the water-cooled condenser section of the retort. Ultimate temperature attained in the hot zone is 920 deg. C.

Before the sponge is melted, it is cleaned and briquetted. Briquets 4 in. in diameter and 2½ in. thick are formed at 200 tons pressure. These briquets are then melted to ingots in a graphite resistor-type vacuum furnace or sheathed and rolled to about 1 in. diameter rods for use as consumable electrodes in an arc furnace.

#### SHEET PRODUCTION

The graphite and arc ingots are sheathed in mild-steel tubing, forged, and rolled to sheets of desired size.

Steps three and four, purification of the chloride and reduction with magnesium, are carried out in stainless-steel retorts heated by pit-type electric furnaces with inside dimensions 30 in. diameter by 70 in. depth. The new plant is equipped with seven of these furnaces, which may be used interchangeably for purification or reduction.

The vacuum distillation step is carried out in vertical retorts of 29 in. inside diameter, and constructed of ½ in. mild steel plate. Five of these retorts are provided in the new plant, with three bell-type electric vacuum furnaces used interchangeably for heating the upper portion of the retort. All furnaces in the plant are provided with blowers for forced-air cooling to shorten operating cycles.

#### DUCTILE ZIRCONIUM: FROM LIMBO TO RENAISSANCE

A few years ago, a "rare" metal was something you could find on a Periodic Table and nowhere else. Looking for a zirconium expert on an industrial level was like looking for a two-headed centaur.

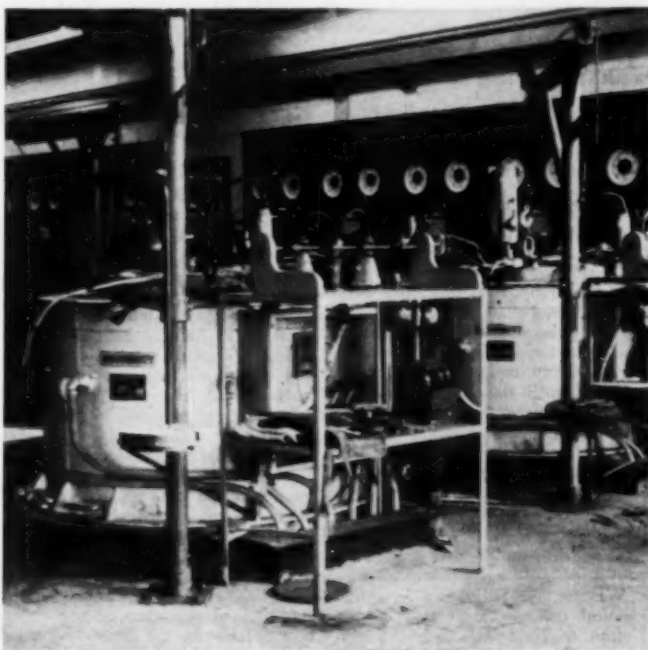
Zirconium metal was couched even deeper in obscurity than any of the others. After being isolated by Berzelius in 1824, the metal was put aside as useless because of its brittle nature. The metal lay dormant for over 100 years until Van Arkel and De Boer, aware of the reactivity of hot zirconium with oxygen and nitrogen, prepared the metal in vacuum apparatus by an iodide process.

Soon it was apparent that the ductile metal held promise for more uses than a safety pin. Unsurpassed resistance to corrosion made it valuable for such things as cranial plates and bone pins in surgery. Low absorption of neutrons made it desirable in atomic piles. But most important of all was the metal's resistance to acids and alkalis of all concentrations and temperatures.

Present demands call for the metal in ton quantities with the U. S. pre-empting the entire supply, and more than one industrialist looking hungrily toward the day he can get his share. There's no shortage of the ore, zirconium ranks high in abundance of metals in the earth's crust—in greater supply than copper, zinc or lead. Chief sources of supply are the beach sands of India, Brazil and Florida. The big problem, rather, is turning out the metal on a grand scale at a reasonable cost. Not enough operating data are available to say which is the better process, the iodide or the newer Kroll, although the iodide process is said to yield a purer metal.

At this writing, more than one industrial producer is running up the electric bill after hours to improve the two present processes or to come up with a new one. Four companies are known to be making the metal at present with more to come. The Kroll process is described on these pages.

"NEW" METAL promises to find more uses than a safety pin.



Crude zirconium tetrachloride purified by resubliming in a stainless steel furnace.

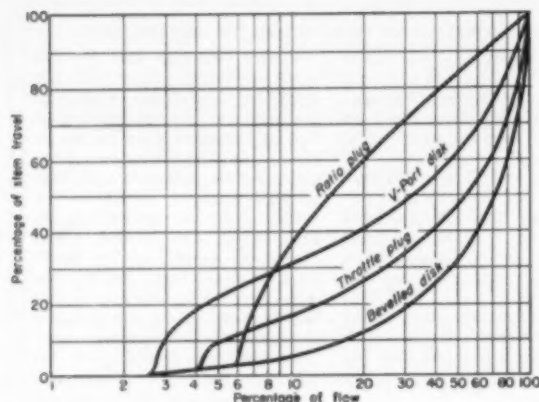


Fig. 1—Characteristic curves for some typical control valves.

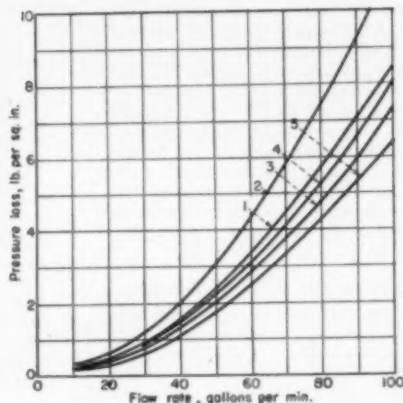


Fig. 2—Pressure losses differ with calculation method.

## Control Valves— Their Action and Selection

What is the significance of control valve characteristics and how should one go about selecting a valve of proper type? The author throws light on some of the confusing aspects of the subject.

WERNER G. HOLZBOCK

Most automatically controlled processes are regulated by adjusting the flow of a fluid, which means that the final element of the controller must be a control valve. Such a valve is a variable orifice that in most cases is brought to a desired opening by air pressure from the controller, applied to a diaphragm driving the valve stem. Most of what is to be discussed here applies primarily to such air-operated valves, although the fundamental flow characteristics apply also to the less frequently used electric valves.

Flow through the orifice of a control valve follows the well known orifice equation:

$$Q = kA\sqrt{2gh}$$

where  $Q$  is rate of flow,  $k$  is a constant taking care of contraction and the velocity of approach factor,  $A$  is the orifice area,  $g$  is the gravitational constant and  $h$  is the pressure differential

across the orifice. If we combine the gravitational constant with the coefficient  $k$ , as a new coefficient  $k'$ , a simpler equation results:

$$Q = k'A\sqrt{h}$$

Examining this equation it is clear that if we keep  $h$  constant and change the orifice area  $A$ , then the rate of flow  $Q$  must change. However, if as a consequence of the variation in  $Q$  the pressure differential  $h$  also varies, then  $Q$  is further influenced. The balance between  $Q$  and  $h$  that will finally be obtained cannot be analyzed by simple mathematical means. Valve characteristic curves provided by the valve manufacturers are based on the assumption that the pressure differential across the valve is constant. This is known as the *inherent* characteristic of the valve. The *effective* characteristic obtained in actual use will depend on the way  $h$  varies in the actual installation and must be determined for that installation by experiment. Thus the inherent characteristic is of value only in showing the general behavior of the valve and must not be considered as exact information.

A valve characteristic curve consists of a plot of flow against the lift, or distance that the valve disk has moved away from its seat, usually expressed as a percentage of total lift. This relation will not necessarily be linear but depends on the shape of the disk or plug. The most commonly used types are the bevelled disk, V-port disk, throttle plug and ratio plug. The first is simply a development of the ordinary hand-operated valve, while the latter three are mathematically designed to give certain inherent flow characteristics which are more suitable for special control conditions. The mathematical shapes are known as characterized valves.

Except for special conditions the cheaper and simpler bevelled-disk valve is generally the best choice. Characterized disks and plugs have to be machined to close tolerances. Because the shape is critical such valves can lose their characteristics in severe service, especially where scaling, corrosion or erosion are met. On this point, Feller<sup>2</sup> states that because of its small clearance at low lifts, the ratio

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plug should not be used to handle liquids carrying suspended solids or coking materials. He recommends the throttle plug valve for such service since it has better characteristics than the bevelled disk and gives larger flows at low lifts than the ratio plug valve.

Characteristics for the bevelled disk and the three characterized valves are shown in Fig. 1.<sup>1-3</sup> The latter show continuous characteristics above about 5 percent of maximum flow (or about 8 percent in the case of the ratio plug). The characterized valves are thus useless for control of very small flows, whereas the bevelled-disk valve gives good regulation at low flow rates. It is true, though, that using it for continuous operation at small flow rates will produce wire drawing, so that it is good practice to select a valve that will normally be about 60 to 75 percent open.

Another advantage of the bevelled-disk valve is its shorter lift as compared with the characterized valves. This reduces time to travel from one valve position to another, lessens the lag in reaching a new flow rate called for by the controller, and so in effect increases the sensitivity of the control system. Short lift does have the disadvantage of increasing the upsets caused by hysteresis and dead zones. However, these are of little consequence when valve positioners are used, as we shall see later. Furthermore, as will also be discussed later, controller sensitivity may have to be adjusted from time to time in applications having large load changes, if a bevelled-disk valve is used. A characterized valve may avoid this need.

The bevelled-disk valve gives fairly linear relations between flow and lift up to about 80 percent of its capacity. The characterized valves, however, are usually intended to approach equal percentage changes in flow rate for equal changes in lift. There are also characterized valves on the market that are more nearly linear than a bevelled-disk valve. The closer the curve comes to a straight line on the semi-log coordinates of Fig. 1, the closer the valve comes to equal percentage characteristics. When plotted on a rectangular grid, however, the closeness of approach to a linear response can be shown.

#### PRESSURE LOSSES

In a bevelled-disk valve the port area is proportional to the amount of lift so that its characteristic would be linear if  $h$  could be kept constant. Even for the valve alone this cannot be done, since there are pressure losses in the valve body which will also vary with  $Q$ . If  $Q$  were a function only of

the lift  $n$ , then  $Q$  would equal  $kn$ , where  $k$  is a constant. If  $h$  is the total pressure differential across the valve and  $h_v$  is the pressure loss in the valve body, then

$$Q = k_1 n \sqrt{h_1 - h_v}$$

where  $k_1$  is a constant. However, for a typical bevelled-disk valve, the characteristic based on a constant pressure differential shows that  $h_v$  varies almost as the square of the flow rate  $Q$ , so that  $h_v = k_2 Q^2$ . Therefore we can write (where  $k_2$  is also a constant):

$$Q = k_2 n \sqrt{h_1 - k_2 Q^2}$$

which shows that the smaller the pressure loss in the valve body  $h_v$ , the more nearly linear will the valve characteristic be. However, we have still failed to consider the pressure loss in the piping. Even when the piping loss is negligible, there are still certain limits that should be observed.

If it were intended to make the pressure loss in the valve as small as possible, a larger than normal valve could be used. However, this would mean that the valve would operate with a lesser lift for a given flow and would thus increase the danger of wire drawing and clogging. A better way is to increase the valve body size without increasing the orifice diameter and construct the body to minimize turbulence, but this is a matter of valve design rather than selection.

It is often desired to increase the pressure loss through the valve, rather than to decrease it. The last equation given holds true only as long as the pressure differential across the valve remains constant, which will not occur in practice. There is inevitably a pressure loss in the connecting piping which has the same effect on the valve performance as the loss in the valve body. Unfortunately, it is less predictable than the loss in the valve. Where the valve manufacturer can verify the inherent characteristic, he cannot do so for the effective characteristic which depends on the conditions of the individual installation. Although these are ordinarily calculated by the engineer who specifies the installation, it is usually next to impossible to determine the pipe losses with accuracy.

Why this is true is evident from Fig. 2. This chart shows curves of pressure loss for 100 ft. of new 2-in. wrought-iron pipe carrying water. The first three curves are based on identical conditions but are calculated by different methods. Curve 1 uses Marks' Handbook<sup>4</sup>, pp. 264 to 270. For Curve 2 the data are from Table 14 in Terrell Croft's "Steam Power Plant Auxiliaries" and Accessories.<sup>5</sup> Badger and McCabe's "Elements of Chemical Engineering," pp. 34 to 39, is the source

#### NOMENCLATURE

- A = Area of orifice, sq. ft.
- g = Gravitational constant, 32.2 ft. per sec.<sup>2</sup>
- h = Pressure differential across the orifice, ft. of fluid.
- h<sub>1</sub> = Total pressure differential across the valve, ft. of fluid.
- h<sub>v</sub> = Pressure loss in valve body, ft.
- k = Orifice constant.
- k' = Constant =  $k(2g)^{1/2}$ .
- k<sub>1,2</sub> = Constants.
- n = Valve disk lift, inches.
- p = Pressure loss in pipe, ft. of the fluid.
- Q = Flow rate, cu. ft. per sec.

of Curve 3. When the temperature changes, both viscosity and density change, thereby affecting the pressure loss. Curve 4 corresponds to Curve 1, and Curve 5 to Curve 3, except that in the first of these the temperature is 70 deg. F., and in the last, it is 160 deg. F.

The discrepancies between these curves are due to the need to rely on experimental data which cannot be duplicated exactly. They are shown to emphasize the point that piping losses cannot be predicted accurately. To make matters worse, the internal condition of piping can vary widely and can change markedly with age. It is for such reasons as these that there is a tendency to make the pressure loss in the valve high. Eckman<sup>6</sup> recommends that the pressure differential at the valve be at least 60 percent and preferably 70 percent of the available differential. Similarly, Ross<sup>7</sup> suggests at least 40 percent, and preferably above 60 percent.

Need for high pressure loss in the valve means that the total available pressure in the piping must be high. Rewriting the last equation to include  $p$ , the pressure loss in the pipe, we have:

$$Q = k_1 n \sqrt{h_1 - k_2 Q^2 - p}$$

It is clear that where  $h_1$  and  $k_2 Q^2$  are high compared to  $p$ , a change in  $p$  will have a relatively small effect on  $Q$ —which is the desired condition.

Where the valve characteristic makes little difference, a valve of low pressure loss may sometimes be chosen as more economical. Another case where high loss in the valve may be unimportant is where there is an orifice flowmeter in the same line. Such an orifice in itself may easily cause a 70 percent permanent pressure loss.<sup>8</sup> A suggestion of Rhodes<sup>9</sup> may sometimes be used to advantage, namely, to install a constant-pressure valve just ahead of the control valve.

#### VALVE AND PROCESS

Except in processes using off-and-on control, where the characteristic of



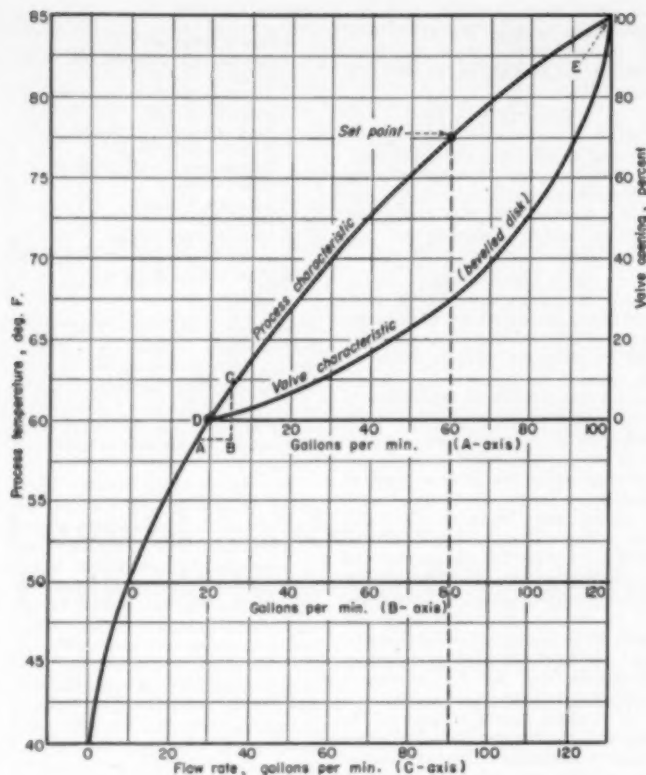


Fig. 3—Characteristic for bevelled-disk valve superimposed on process characteristic curve to show effect of heterogeneity of curves on type of control achieved.

the valve is of no consequence, it is usually necessary to consider the characteristic of the valve in relation to that of the process. Proportional control, with or without the addition of reset or derivative action, is the usual choice. This means that corrections applied by the controller will normally be proportional to departures from the control point.

However, it is not necessarily true that the valve should have a characteristic with the same shape as that of the process. Consider Fig. 3 which is a plot of two curves, one the temperature response of the process to changes in rate of flow of a heating medium; the other the characteristic of a bevelled-disk valve. It is assumed that the response of the controller itself is linear. (This is not always true, and needs careful consideration in practice. Temperature and flow controllers are often non-linear. Ross<sup>11</sup> gives details on this point.)

In Fig. 3 we assume that the process fluid may be supplied at any temperature between 40 and 60 deg. F.

and that it is to be heated in the process to 77.5 deg. F. Assume first that it is supplied at 60 deg. at which point the control valve will be closed and the flow of heating medium will be zero. In this case we use the A-axis of abscissas. To heat the substance to 77.5 deg. F. requires a flow of 60 gpm. of heating medium, requiring the valve to be opened 30 percent. Instead, if the initial temperature is 50 deg. F., the B-axis must be used and the rate of flow for a 77.5 deg. temperature will be 80 gpm., corresponding to a 51 percent valve opening. Finally, if the initial temperature is 40 deg. F., using the C-axis it is evident that a flow of 90 gpm. will be required for heating to 77.5 deg. F., corresponding to a 68 percent valve opening.

At any point on the process characteristic curve, such as point D, the tangent shown by the triangle ABC represents the relation of temperature change to flow rate change. At 40 deg. the tangent is about 1.54 and at 60 deg., about 0.35. A change of

temperature from 40 to 42 deg. will require a decrease in flow rate (in heating to 77.5 deg.) of  $2/1.54 = 1.3$  gpm., or a decrease from 90 to 88.7 gpm. which corresponds to a change in valve opening from 68 to 65 percent. Similarly, a change of temperature from 60 to 62 deg. F. will require a decrease in flow rate (in heating to 77.5 deg. F.) of  $2/0.35 = 5.7$  gpm., or a decrease from 60 to 54.3 gpm. which corresponds to a change in valve opening from 30 to 26 percent.

In the first case the valve has to move 3 percent of its total travel to adjust for a 2-deg. change, and in the second case, 4 percent. The difference is accounted for by the heterogeneity of the curves. The degree of heterogeneity can be expressed by comparing the valve travel produced by the same load change for a number of different initial conditions. In this case, for example, the factor of heterogeneity is  $4/3 = 1.33$ . The larger this factor, the more uneven will be the control action, as we shall see.

Consider the use of an ideal valve having the same characteristic curve from D to E as that of the process in Fig. 3. The conditions otherwise are the same. Heating from an initial 60 deg. F. to a final 77.5 deg. F. still requires 60 gpm., but the valve opening is now 70 percent. Heating from an initial 40 deg. F. to a final 77.5 deg. F. still requires 90 gpm., but the valve opening is now 94 percent. If the 40-deg. initial temperature is raised to 42 deg., dropping the demand to 88.7 gpm., the valve opening decreases about 1 percent from 94 to 93 percent. If the initial 60 deg. temperature is raised to 62 deg., dropping the demand to 54.3 gpm., the valve opening decreases about 5.5 percent from 70 to 64.5 percent. Thus the factor of heterogeneity becomes  $5.5/1 = 5.5$ , which is larger than that for the bevelled-disk valve, and would give poorer control.

#### EFFECT OF THROTTLING RANGE

A proportional controller possesses a so-called throttling range or proportional band, which is the percentage of the scale range of the instrument needed to move the control valve from full open to full closed, or vice versa. In a temperature instrument, for example, if the scale range is 200 deg. F. and the throttling range is 40 percent, it requires a change of  $0.40 \times 200 = 80$  deg. F. for full valve movement. The throttling range is distributed equally about the control point, so that if the instrument is set to control at 100 deg.



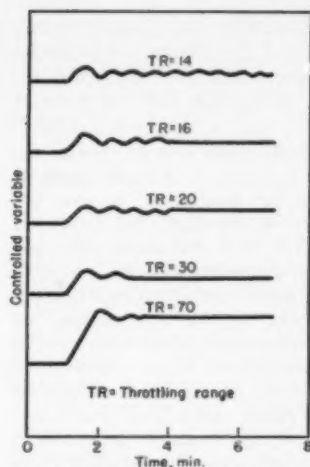


Fig. 4—Percentage of throttling range affects both sensitivity and droop of a process control instrument.

F., the valve will be fully closed at 140 deg. F., and fully open at 60 deg. F. As pointed out by Nuneviller and Vollrath<sup>9</sup> from whose article Fig. 4 is taken, the throttling range adjustment can be used to increase or decrease control sensitivity, thus permitting stabilization of the control action. Sensitivity increases in direct proportion as the throttling range is decreased.

Throttling range can be expressed, it is evident, as the relation of valve movement to change in the measured variable. But we have already seen that the relation between valve and process characteristics can result in changes in the required valve travel per unit change of the initial temperature. Thus a decrease of required valve travel per unit temperature change has the same effect as increasing the throttling range and therefore corresponds to a decrease in sensitivity. The extent to which the sensitivity changes between two different control conditions is expressed by the factor of heterogeneity already mentioned.

In Fig. 4 it is seen that increasing the throttling range not only decreases the sensitivity, but it also increases the droop. This is the shift from the original control point at which the control stabilizes after a change in load. Even when the controller is of the reset type, the reset rate must change considerably with change in sensitivity.

As the throttling range is reduced (sensitivity increased), changes in sensitivity due to a high factor of heterogeneity become less pronounced. Ross<sup>12</sup> states that with a narrow throt-

tling range such as 10 percent, where a 2 percent change in pen position results in a 20 percent change in valve lift, the effect of any particular valve characteristic is lost. In such a case the valve action approaches two-position operation.

From these facts we can conclude that with a process which deviates only a small amount from the set point, no particular valve characteristics need be taken into account. In Fig. 3, for example, small oscillations about the 40 deg. F. initial temperature would produce a linear valve response even with the bevelled-disk valve. Here a higher percentage of the total pressure loss could be taken in the pipe than under more exacting conditions. Similarly, if a narrow throttling range, such as 10 percent or less, were used the valve characteristic would have a negligible influence on the control process.

However, with considerable swings in the measured variable, a different situation holds. If the changes occur at rare but well-known intervals and always between the same limits, it is sometimes feasible to adjust the throttling range to known values whenever the initial temperature changes, thereby making it possible to neglect the valve characteristics as above. But if such adjustments are undesirable, then a characterized valve should be used, having a flow-lift characteristic that corresponds to the process characteristic.

Although we have discussed load changes only as changes in the initial temperature of the substance being heated, there are other possible load changes which involve similar analyses so far as valve selection is concerned. Such might be change in the temperature or flow rate of the heating medium. However, when more than one load change enters into the analysis it appears that no valve characteristic can meet all possible combinations, and any valve choice will necessarily be a compromise.<sup>14</sup>

#### VALVE POSITIONERS

Similar to the effect of reduced sensitivity in a controller is the existence of dead zone and hysteresis in control valves. These effects are caused by friction in the valve. The first is best described as the pressure change necessary to overcome friction and start a change in valve lift, while the second can be defined as the difference in valve position for the same air pressure on the diaphragm that will be reached with ascending pressure, and with descending pressure. Fig. 5 shows an exaggerated case of hysteresis reported by Olson<sup>10</sup> as due

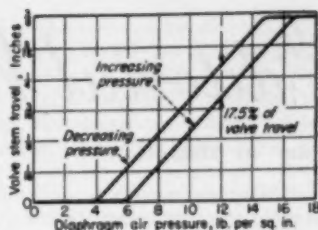


Fig. 5—Valve hysteresis can upset the control. Here is a bad case of hysteresis caused by a too-tight stuffing box.

to a tight stuffing box. It emphasizes the damage that can result from poor maintenance of an otherwise correctly selected valve.

Where precise control is needed, as it is in many cases, a valve positioner should be used to overcome the hysteresis. With a positioner the controlled air pressure is applied not to the valve diaphragm but to a small position controller attached to the valve. This device then forces the valve to assume the position called for by the controller. Eckman<sup>4</sup> states that a positioner will reduce the dead zone in positioning the average control valve from about 0.60 percent to one-fifth that amount, reducing the hysteresis from more than 2 percent to less than 0.20 percent of full valve travel. As Wery<sup>13</sup> has pointed out,<sup>13</sup> by increasing the power of the valve positioner, it may be possible to use single-seated rather than double-seated valves.

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# Editorial Viewpoints

## Parr at Illinois

"Wherever research in coal and coke is carried forward, wherever water treatment has made for economy and efficiency of steam boilers, wherever the metallurgy of alloys is an aid to industry, there one will find commerce and industry indebted to, and building upon, the work of this able chemical engineer."

So, in 1937, wrote his long-time associate and great admirer, Justa M. Lindgren, in urging friends and former students of Samuel Wilson Parr to join in placing a memorial plaque in the University of Illinois Y.M.C.A. Later this month his alma mater will pay even more fitting tribute to this pioneer teacher and leader of the chemical profession.

On March 30 a fine new five-story building housing the laboratories of chemical engineering and biochemistry will be appropriately dedicated to the memory of Professor Parr. This occasion will mark a significant milestone in the history of chemical engineering at Illinois. Sixty years ago, in January 1891, the young Parr returned from his European studies to become professor of applied chemistry at the University of Illinois. Ten years later he introduced the first chemical engineering curriculum at that institution. For forty years he directed researches that have profoundly affected basic industries of Illinois and of the nation. Perhaps he is best known today for the Parr calorimeter and related instruments and analytical equipment widely used in the fuel industries. Important alloys such as Illium and Chromel came from his laboratories.

Parr's name has always been closely linked with that of the late William Albert Noyes and other early Illinois chemists, who have been honored throughout the world for their scientific achievements. It is most appropriate, therefore, that their illustrious successors, Adams, Marvel, Johnstone and Rose—to name but four—should carry forward their productive careers in laboratories named for such worthy pioneers.

## A Powerful Weapon—In the Right Hands

Specifications and standards provide democracy with the strongest weapon in its arsenal—mass production. And experience shows that the best standards—the ones that work—are those willingly agreed upon after thorough study by all who have to use them.

Now, however, harried bureaucrats in Washington are urging the government to take over the writing of industrial standards. This is vigorously opposed by Ralph E. Flanders, liberal Republican from Vermont.

"On the day that standards become a governmental function and responsibility," warns Senator Flanders,

"the government will take a very long step toward the control of American industry. . . . The thousands of purchase specifications they hand down," he says, "are as likely as before to be unrealistic, uncreative and unnecessarily expensive. With this added difference: their errors can now be a thousand times more serious."

What then does he propose? Continued development of standards under the consensus principle, and on a voluntary rather than a compulsory basis. And he wants all groups—manufacturers, designers, distributors, sellers, consumers and the government—to frame the standards, with none pulling rank on the others.

He cites the American Standards Association as "private industry's primary answer to the challenge of government control of standards activities." The ASA has approved 1,139 standards now in effect, 149 of them in 1950. During World War II, it helped to develop about 500 standards; now it's busy on work for the rearmament program.

The Senator calls for a modification, but no scuttling, of the voluntary consensus principle in development of war standards. He insists that full use be made of the technical and creative abilities of American industry, that war standards stick close to current industrial practice. To which the chemical industry, wise in the ways of brass and bureaucrats and aware of what havoc unrealistic specifications and standards can wreak on production schedules in chemical process plants, breathes a fervent and audible "Amen."

## Divide by Three

During wartime it's only natural that scarce and vital materials should be divided between military and essential civilian demands. Now a third claimant—foreign countries that must be served from America—has been officially recognized by the Office of Defense Mobilization. Director Wilson has, in fact, set up a special committee to receive and appraise foreign applications.

This is fortunate. It is certainly a major improvement over past practice, when the State Department often decided in favor of exporting scarce materials purely for diplomatic reasons.

Chemical management will be involved in many of these cases. Executives of our industries should therefore prepare to meet proper foreign claims as well as to refute those that are not justified.

Foreign claimants for scarce chemical commodities must expect to be served only if they make sincere and effective efforts toward two-way cooperation. It is not necessary that this be done merely by barter; yet they should, whenever possible, reciprocate by sup-

plying United States users with materials urgently needed in this country.

This is a time when all free nations must pool their resources and pull together for mutual defense and security.

### **Watch Safety**

Safety records of manufacturing plants dropped last year. More work injuries developed during the last half of the year—apparently a result of Korea.

There will be mounting pressure this year for more production from most chemical plants. This means new and unskilled workers, overtime and unusual night work. These and other emergency factors tend to increase the dangers of plant operations.

But none of them justifies a letdown in your safety regulations or standards of proper operation. Now, more than ever, it is vital to improve your plant's safety record.

### **Message from AEC**

Atomic Energy Commission has always recognized the importance of industry's cooperation on all phases of its program. Still it is heartening to note the positive way the Commission recently stated its policy of encouraging greater participation by industry:

"The Commission will undertake cooperative activities with industrial concerns or groups of concerns to explore possibilities for their participation—on their own initiative using their own resources—in development of applications of atomic energy for power purpose in such manner and extent as to insure: (1) maximum attention to the atomic energy production program in all its phases; (2) special effort being placed on those matters that will be productive in the relatively near future (one to three years); (3) the application of the best available brains to all the important problems of the Commission."

This is clear recognition of the vital importance of sincere joint efforts by business and Government in the atomic energy field. We hope that more American chemical firms will decide on cooperative programs with AEC.

### **Sulphur's Bright Spots**

Only a few months ago the chemical industry was asking, with alarm and pessimism, "Now that our reserves of Frasch-minable sulphur are dwindling fast, where and how can we get cheap sulphur in the future? Will the price of this basic commodity rise until it distorts the economic structure of our entire chemical process industries?"

True, it is frightening to think of a chemical economy based on scarce, high-cost sulphur. But our precipitous pessimists didn't stop to reckon with the

engineering ingenuity that runs throughout our industry. This ingenuity shows up best in times of emergency; it's showing up now.

Even in this issue, on page 105, is the announcement of a new agglomeration process to extract sulphur from low-grade ores; some engineers believe that it may prove to be the answer to the long-range sulphur problem. Another process, using solvent extraction, is being tested in a South American plant. And we do know that our present major producers of sulphur have first-class engineering talent that is facing the issue squarely and with economic realism.

We don't know yet how close we are to the real answer or answers. We do know that a lot of engineers are focusing their attention on this problem, and we have great faith in their ingenuity.

### **Nothing Ever Happens?**

"What chances are there for engineers to get ahead in the old-line inorganic chemical industries? Nothing much ever happens in them; they're too static. Now in the organic field, there's where things happen!"

Such has too often been the line of thought that young engineers have taken in their mass exodus to the green pastures of organic engineering.

But who can say nothing ever happens in inorganic technology? It's happening right now—exciting little revolutions in their own rights. Daring and unorthodox engineering is now making history in the sulphuric acid, phosphorus, chlor-alkali, sulphur, nitrogen and other "static" inorganic industries. The same holds true for the fertilizer, glass, ceramics and other "old-line" chemical process industries.

So to those young engineers who are looking for tough challenges and real opportunities, here's our advice: Take a fresh look at an old industry!

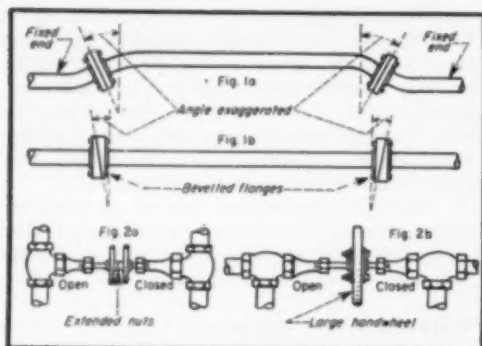
### **Patriotism Will Pay**

Transportation is going to become a bottleneck limiting capacity operations of a number of enterprises in the near future. And within the transportation system the availability of tank cars and box cars may be the limiting item.

What can our industries do to relieve this pressing shortage? One way to speed up the cycle is for chemical plants to put in a six or even a seven-day system for loading and unloading of cars.

There are pocketbook reasons, too, for such patriotic cooperation.

The extra cost will be small compared with a loss due to intermittent operation or full shutdown when a shortage of some important component ties up a whole production line. Demurrage charges will be reduced. And there is an extra advantage: railroads give increased cooperation to their patrons who use empties promptly and unload incoming cars without delay.



## Overcoming Some Common Difficulties With Pipe and Valve Systems

B. HORNUNG, Consulting Engineer, B. Hornung & Associates, Montevideo, Uruguay.

### ★ January Contest Prize Winner

Here are a few kinks that will solve problems often encountered in piping installations.

The first idea takes care of the difficulty that occurs in a straight run of flanged pipe which has to be taken down from time to time for cleaning or other reasons. If the corresponding flanges are rigid—for example, if fastened to two pieces of equipment, or if their connecting piping passes through walls—then it is difficult to separate the flanges. Figs 1a and 1b show two methods of making the removable pipe section into a wedge which can be easily slipped out of or into place. The angle, of course, is much exaggerated and needs to be only a few degrees. The first method involves using normal flanges, but depends on putting a slight bend in the attached pipes. The second uses straight pipe, and depends on machining the flanges to a slight bevel. The slight angle introduces no problem in converting the flange faces from circular to oval. It is only necessary to remember to mark the flanges.

The second idea provides a foolproof solution to the problem of interlocking two rising-stem valves for certain specified methods of operation. Fig. 2a shows an arrangement suitable for two valves where both can be closed, but

only one can be open. Examples of such a system occur when a tank is to be fed from two alternate sources which must not be used simultaneously; or with a cooling and heating supply provided on the same pipe coil; or when drains are to be diverted to two different disposal systems.

In this arrangement the two valves are installed with their handwheels looking toward each other. Extensions on the stems are of such a length that when one valve is closed, the other can be almost completely open. Obviously, both can be closed but only one can be fully open.

Instead, if one of the valves must always be open, while the other is always closed, it is simply necessary to bolt the two handwheels together as in Fig. 2b. A larger handwheel bolted between the two smaller ones belonging to the valves makes a handy arrangement, as the sketch shows. A wheel from a discarded larger valve, or from a junked automobile serves well for the purpose. Any matched pair of valves can be used in this way. Sometimes angle valves will give the best arrangement as in Fig. 2b, and even Y-valves can be used if two lines are to branch from a single source. If the valve pair is to be operated from a distance a sprocket or V-belt sheave can be substituted for the large handwheel.

There are, of course, a number of other methods of interlocking which may be preferred under suitable circumstances. To open or close two or more valves at the same time, they can be operated through chains and sprockets driven from a common handwheel. Quick-opening valves and plug cocks can be synchronized by connecting rods linking their operating levers. Diaphragm valves can sometimes be operated simultaneously by having a bar arranged to press on two or more diaphragms at the same time.

## Combination Device Handles Three Steps in One Simple Unit

A. W. BILLITZER, Beckers Pty. Ltd., Dudley Park, South Australia.

Shown here is a unit which was designed and built to eliminate handling of an aromatic amine hydrochloride filter cake containing toluene. This it accomplishes without fire hazard and without danger to personnel from the toxic toluene. These requirements ruled out centrifuging and manual transfer of solids to the hydrolyzer to recover the free aromatic amine.

### ★ February Contest Prize Winner

#### "Improving Control of Specific Gravity With a Fluid-Response System."

A prize of \$50 in cash will be awarded to John F. Schnacky, chemical engineer and manufacturers' representative, Buffalo 22, N. Y. The prize winning entry will appear in the May issue.

**\$50 PRIZE FOR A GOOD IDEA**—Until further notice the Editors of Chemical Engineering will award \$50 cash each

month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the March winner will be announced in April and his article published in May. Judges will be the editors of Chemical Engineering. Non-winning articles submitted for this contest will be published if acceptable at space rates.

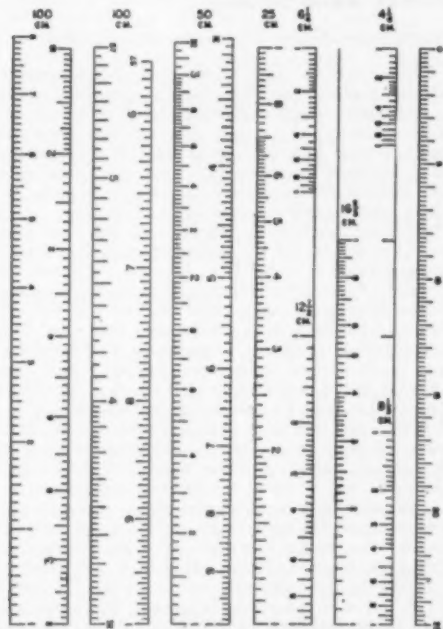
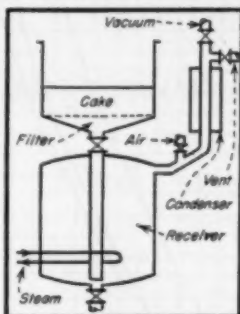
**HOW TO ENTER CONTEST**—Any reader of Chemical Engineering, other

than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible.

Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data are acceptable. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 18, N. Y.



The combination unit serves successively as a filter, dissolver and hydrolyzer. First the salt slurry in toluene is filtered by suction, the upper portion of the unit acting as a nutsch filter. After washing the cake the receiver is flushed with clean toluene and is then filled with 10 percent NaOH solution which is first warmed to 70 deg. C. and is then forced upward by air pressure through the Monel filter cloth to dissolve the cake. Freeboard is adjusted to make sure that the caustic will not overflow. Pressure is released and the part hydrolyzed, part dissolved cake is drawn into the receiver. About three repetitions is needed to withdraw all cake from the filter surface. All valves except the vent are now closed and the hydrolysis is completed by refluxing. The mixture of recovered aromatic amine containing some toluene and aqueous liquors is now run off by gravity to a separator.



### Logarithmic Modulus Chart Speeds Construction of Nomographs

D. S. DAVIS, Professor of Chemical Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

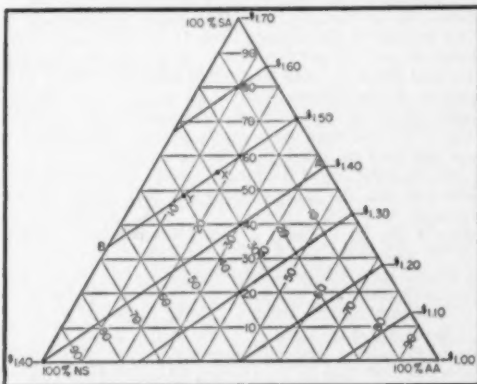
Alignment and line coordinate charts make use of simple logarithmic scales more often than any others. Although these can be laid off with the aid of a table of logarithms, most nomographers prefer the convenience and accuracy afforded by marking the desired points along

already prepared logarithmic scales. The most ideal method for constructing logarithmic scales with moduli of  $4\frac{1}{2}$ , 6 $\frac{1}{2}$ , 8 $\frac{1}{2}$ , 12 $\frac{1}{2}$ , 25, and 50 cm. employs a triangular Keuffel and Esser Paragon scale. A fairly practical substitute is the pencil-of-lines modulus chart found in the pocket of one of the texts on nomography<sup>1</sup> or the one described previously<sup>2</sup>. Some nomographers depend upon logarithmic graph paper for their scales or strip the A, B, C, and D scales from inexpensive slide rules.

The most satisfactory substitute for a commercial, engine-divided scale, depicted in reduced form in the accompanying figure, has evolved from blueprints and ozalid prints in use in the author's classes for 20 years. The present chart, printed from a cut and obviating the expansions and contractions that characterize other types of reproduction, permits rapid and accurate construction of logarithmic scales of moduli of  $4\frac{1}{2}$ , 6 $\frac{1}{2}$ , 8 $\frac{1}{2}$ , 12 $\frac{1}{2}$ , 16 $\frac{1}{2}$ , 25, 50, and 100 cm. The 50-cm. scale is folded in two parts; one ranges from 10 to 32 and the other from 31 to 100. The 100-cm. scale is folded in four parts which have the ranges of 10 to 18, 18 to 32, 32 to 57, and 57 to 100. A natural scale 25 cm. long graduated in 2-mm. divisions completes the chart. Logarithmic scales with moduli of 33 $\frac{1}{3}$  and 200 cm. can be attained through marking points at the squares of the actual values along scales of moduli of 16 $\frac{1}{2}$  and 100 cm., respectively. A full scale reproduction of the modulus chart (8 $\frac{1}{2}$  x 11 in.) can be obtained from the Virginia Polytechnic Institute bookstore at Blacksburg, Va., for 25 cents plus postage.

### REFERENCES

1. Davis, D. S., "Empirical Equations and Nomography," p. 105, McGraw-Hill Book Co., Inc., New York, 1943.
2. Lipka, Joseph, "Graphical and Mechanical Computation," John Wiley & Sons, Inc., New York, 1918.



### Ternary Diagram Simplifies Figuring Raw Materials Costs

FRANK C. BYRNES, Midwest Editor, Chemical Engineering, Chicago, Ill.

Although ternary diagrams may look a little terrifying to those not accustomed to using them, a little study will show that they are ideally suited to the simplifying of calculations involving three variables. Such a case is the common one where three different raw materials can be used to provide the same ingredient and it is desired to calculate the cost with varying percentages of each material. A typical example is encountered in mixed fertilizer



formulation where plant food nitrogen is generally derived from varying amounts of three raw materials which are blended with a mixture of superphosphate, potash and other materials. The method will be explained in that connection, although it will be obvious that it can be used in other applications.

The three nitrogen sources commonly used are anhydrous ammonia (82 percent N), nitrogen solution (41 percent N), and sulphate of ammonia (21 percent N). The fertilizer trade calls each percent of nitrogen in the final mixture a "unit," so that in a 2,000-lb. ton of fertilizer, a unit of nitrogen is 20 lb., while a fertilizer containing three units contains 60 lb. of nitrogen per ton. A material such as anhydrous ammonia then contains 82 units of N per ton, and the per-unit cost of nitrogen in anhydrous is the delivered and unloaded cost per ton, divided by 82.

Assuming, then, that the per-unit cost of anhydrous is  $82/82 = \$1$ , of nitrogen solution is  $57.4/41 = \$1.40$ , and of sulphate of ammonia is  $35.7/21 = \$1.70$ , we assign a corner of the triangle to each material, and mark down its per-unit cost. The most natural arrangement seems to be to put the lowest cost in the lower right corner, and the highest cost at the apex. Each corner represents two things: (1) the cost of a unit of N from that source, and (2) 100 percent by weight of that material in the fertilizer—but not 100 percent of N, of course.

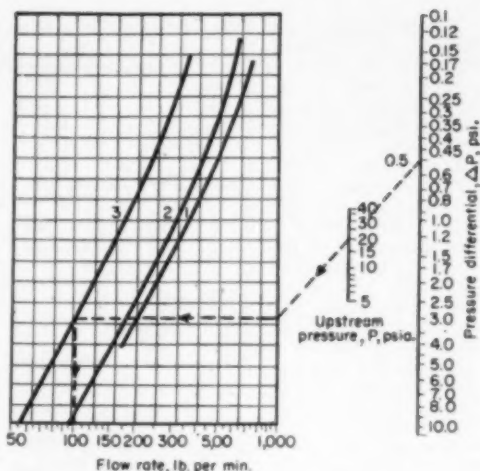
Thus points along the boundaries of the triangle represent mixtures of two of the materials, and points within the triangle represent mixtures of three. Similarly, by drawing lines of constant cost which are comparable to the lines of constant percentage already on the chart, we can immediately locate the cost per unit of any mixture of the components. The cost lines are parallel and any desired number can readily be entered on the chart.

Take the \$1.50 cost line as an example of how this is done. To do the job, note that \$1.50 is  $0.50/0.70 = 71.4$  percent of the distance from \$1 to \$1.70 and lay off Point A at 71.4 percent of the height of the triangle. To find Point B, note that \$1.50 is  $0.10/0.30 = 33.3$  percent of the distance from \$1.40 to \$1.70, and lay the point off at 33.3 percent of the height of the triangle. The other cost lines are similarly located, although only one end need be found, since they are parallel.

All compositions of the three materials lying on any cost line will cost the same amount per unit. Point X, for example, indicates a mixture of 17 AA, 28 NS and 55 percent SA, while Point Y shows a mixture of 12 AA, 40 NS and 48 percent SA, but for both the per-unit cost is \$1.50. In a fertilizer containing three units of nitrogen and made according to composition X, there will be 60 lb. of elemental nitrogen per ton, coming from  $0.55 \times 60 = 33$  lb. in SA;  $0.28 \times 60 = 17$  lb. in NS; and  $0.17 \times 60 = 10$  lb. in AA. The corresponding weights of the three materials are  $33/0.21 = 157$  lb. SA;  $17/0.41 = 41$  lb. of NS; and  $10/0.82 = 12$  lb. of AA. The blend will contribute 60 lb. of nitrogen and will cost \$1.50 per unit, or  $3 \times 1.5 = \$4.50$ .

### Don't Overlook Dryer Roll Ends

In its January 1951 issue *The Paper Industry* describes a money-saving idea that has been used by the Standard Asbestos Mfg. Co. of Chicago. The plant's paper dryer rolls are 3 ft. in diameter, which means about 15 sq. ft. of radiating surface on the dryer ends. The rolls operate at 300 deg. F. and thus can waste appreciable heat without benefit to paper being dried. Application of a 2-in. layer of mineral wool cement to each end of the rolls, put on in three layers, largely eliminated the loss.



### Single Calibration Chart Serves Several Flow Meters

MELVIN NORD, Wayne University, Detroit, Mich.

When orifices or venturi meters are used to measure the flow rate of gases, calibration charts are generally required for each meter. Each calibration chart will consist of a family of curves; for example, flow rate may be plotted against pressure drop, for lines of constant upstream pressure  $P$ . If several meters are in use, and each is read at frequent intervals, the use of a series of such charts proves very tedious, and is likely to cause errors in reading.

In order to simplify the situation, it has been found convenient to plot all the calibration curves on a single nomographic chart of the type shown in the accompanying figure. The construction of such a chart is simple. It involves plotting on log-log paper the flow rate versus the quantity  $P \Delta P$  for a given intermediate value of  $P$ . Since the weight rate of flow is proportional to  $(P \Delta P)^{1/2}$  for a given gas at a given temperature, the curve thus drawn will apply to any combination of  $P$  and  $\Delta P$ . In order to eliminate the need for calculating the quantity  $P \Delta P$  in using the chart, this is performed nomographically at the side of the chart. A logarithmic scale of pressure (increasing upward) and a logarithmic scale of  $\Delta P$  (increasing downward) will be found to perform this function.

In the accompanying figure, calibration curves for three venturi meters, flowing nitrogen at 70 deg. F., have been plotted. The dotted line on the figure indicates the method of using the diagram. Thus, if  $P = 20$ , and  $\Delta P = 0.500$ , the flow rate measured by venturi (3) will be 103 lb. per min. The chart is generally made on log-log paper, but for simplicity of presentation it has been shown here with the log-log coordinates removed and replaced by guide lines. Similar charts can be made for other meters.

If it is desired to plot the volumetric flow rate instead of the weight flow rate, it is necessary to plot the flow rate versus  $(\Delta P/P)^{1/2}$  instead of  $(P \Delta P)^{1/2}$ ; the nomographic portion of the chart will then be altered, so that the pressure scale will now increase downward instead of upward. It is also possible to add additional nomographic scales (preferably below the flow scale), in order to take into account variations of temperature or molecular weight. The latter type of chart has been found very useful where gas composition is subject to substantial variation.

# Four Ways to Head Off Your Manpower Crisis—NOW

1. Hold on to the good workers you have
2. Train and upgrade them
3. Help them to increase their output
4. Know how to find new workers

## TO KEEP WORKERS

Put your wage structure and policies in order. Set up job descriptions, rate ranges, policies on overtime, promotions, incentive plans—all in writing.

Think of your work force in Manning Table terms. Remember what these did in World War II. Analyze jobs—not workers. An argument for deferments.

Start termination interviews to help hold workers. Find out why they're leaving, correct the causes. A third will change their minds, decide to stay.

Set up an absenteeism control program. Absenteeism is always a problem, gets worse when labor is scarce. Don't stress force; don't threat or punish.

Work out ways to jack up morale—then keep it up. Get rid of cynicism, lack of interest. Set up suggestion committees, organize drives and contests.

Review your entire personnel policy. Biggest turnover is in first 3-4 weeks of employment. Concentrate on ways to make new workers feel at ease.

## TO TRAIN WORKERS

Give one person the over-all training job: guarantees real attention and integration. Leave details up to operating supervisors and foremen.

Use the Association of University Evening Colleges. Their programs are designed to help industry everywhere. Write to 17 Lexington Ave., New York.

Get ready to train. Keep an eye open for good instructors. Get facilities in shape. Break down and simplify jobs. Set up a definite program.

Train your supervisors. Pick key men, train them to train others. Remember the Job Methods Training (JMT) courses that helped out in World War II.

Start on-the-job training to upgrade workers. It's simpler, faster, cheaper, sticks better. The "one-notch-up" approach is best. Pays off big for years.

Set up informal classes and lectures. Make them interesting, challenging. Stimulate thinking along practical lines. Don't lecture too much.

## TO INCREASE OUTPUT

Set up a department to study efficiency in each unit. Concentrate on little things; they add up. Methods engineering added 12 percent to one plant's output.

Stimulate the ingenuity of your technical men. Get their ideas flowing, keep them flowing. They'll flood you with ways to increase productivity.

Encourage ideas from your workers. They know operating

conditions best. Set up contests, give awards, write-ups in house organs. They'll pay off.

Get—and keep—the backing of local unions early in the game. Explain what you're doing, how serious the problem is, ask for help. Later may be too late.

Be frank with your workers. Don't make them guess what you're trying to do. Have open meetings, ask for their advice. Democracy pays off in more output.

Make your plant a pleasant place to work. Contented workers have higher productivities. Check eating places, parking areas, recreational facilities.

Spruce up your health and safety programs. Are they as good as you think they are? Be critical—and save money and manpower, up output 2-10 percent.

Concentrate on the little ways to stretch manpower; they're the ones usually overlooked. Little short-cuts add up to big and permanent savings.

## TO FIND WORKERS

Appoint one person chief worker-getter. Let him scout and recruit, leave interviewing details to others. Give him responsibility, freedom of action.

Get the suggestions of your employees. They'll come up with names of friends and relatives. Good workers pick other good workers—the kind you want.

Consider retired workers, disabled veterans, former employees. This can give good returns. But don't lower your health standards too much.

Use your state employment service. Build up a reputation for cooperation; the U. S. Employment Service works closely with all state agencies.

Consider "non-essential" workers in your area. When the going gets tough, they'll switch to essential jobs anyway; you may as well have first bid.

Advertise. Consider local newspapers; cost may be only \$5-\$10 per applicant hired. Also technical publications, business papers, trade journals, local radio.

Contact nearby colleges, universities, trade schools. Visit personally, interview early. Give literature on your firm. Don't overlook girl graduates.

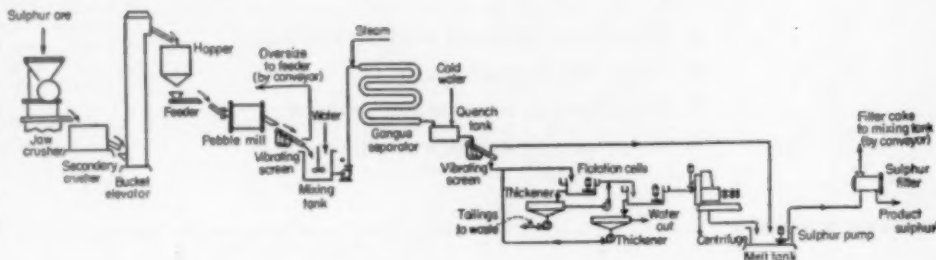
Learn how to interview. Most people don't know how. It's vital if you take on many beginners; you can't judge these by their experience or records.

Check up on your employment policies: physical examinations, application forms (keep them simple and short). It may be worth a lot to loosen up a little.

Make the applicant feel welcome and wanted. Give him prompt and courteous attention; provide good facilities. That first impression is damned important.

DEPARTMENT OF THE MONTH. This department appears in each issue among the ads. Are you using it? To call it to your special attention we are starting it here this month.

## Chemical Engineering News Edited by Joseph A. O'Connor



### New Sulphur Recovery Process . . .

- . . . grinds, slurries, coalesces, floats, melts, filters.
- . . . gets over 90 percent of sulphur from low-grade ores.
- . . . unlocks the earth's vast deposits of surface sulphur.
- . . . promises to compete with Frasch process in the U. S.

**How It Works.** Getting sulphur from low-grade surface ores that contain the free element is one way to lick the growing sulphur shortage. A tantalizing idea, it's been tried before. But it took engineers of Chemical Construction Corp. to turn the trick with a brand new process. Clue to their successful froth flotation method: coalescence of fine sulphur particles into larger aggregates.

In South America, the first commercial plant to use the new process is now being built in Colombia. And negotiations are under way for at least one unit in Wyoming.

In capsule, here's how the seven-step Chemico process recovers sulphur from ores containing the free element: (1) the ore is ground, disintegrating part of its free sulphur into fines; (2) ground ore is suspended in water; (3) the resulting slurry is heated with agitation above the melting point of sulphur, causing the fines to coalesce; (4) the slurry is cooled below the melting point of sulphur; (5) it undergoes a froth flotation, in which a semi-purified sulphur is removed as flotation concentrate; (6) this semi-

purified sulphur is melted; and (7) it is filtered to produce a sulphur of 99-100 percent purity.

Mined ore is ground and screened to -28 mesh, during which part of its free sulphur disintegrates into fines. Ore is ground in three steps, going through a jaw crusher, a secondary crusher and a silica-lined pebble mill for wet grinding. Then it passes through a vibrating screen.

Next, it's suspended in water to form a slurry of about 15-50 percent solids. Slurry is pumped into the gangue separator.

Heart of the process is this gangue separator. Essentially, it's a pipe coil in which the slurry stays only a few minutes. Superheated steam is injected into the narrow passage of the coil, where it mixes directly with the slurry and agitates it. This raises the pressure to 50-75 psi, and heats the slurry to 250-275 deg. F., melting the sulphur. Its high surface tension keeps the molten sulphur from wetting the gangue particles. And eddy currents in the coil cause the sulphur fines produced in the grinding step to coalesce into tiny globules. That's the nub of the process. It means extremely high production

rates, compared with earlier recovery methods that relied on heating alone to separate the sulphur.

Coming from the gangue separator, the slurry drops through a letdown valve and is quenched with cold water to 140-195 deg. F., causing the sulphur droplets to form nodules. Discharge from the quench tank passes over a 20-mesh vibrating screen that separates about one-third of the sulphur as oversize lumps of 92-95 percent purity. These go directly to the sulphur melt tank.

Smaller screened material undergoes a two-stage froth flotation in conventional cells at a pulp density of about 20-25 percent solids. This separates particles of agglomerated sulphur from the gangue. Best results are obtained when the flotation is carried out at pH of about 3.0 and a temperature of 140-195 deg. F. Thickened tailings from the first rougher flotation are discarded, while those from the second cleaner flotation are recycled to the first stage. After 5 min. a semi-refined sulphur concentrate of 80-95 percent purity, depending on the ore, is floated.

(Continued on page 183)

## NEW & IMPORTANT

**NITRATION** has undergone a slow and steady development which has been reflected in the growth of the commercial explosives and dye industries.

**AMINATION** (by reduction) has seen progress in the Béchamp reaction, achieving high capacity, low operating cost, excellent control.

**DIAZOTIZATION & COUPLING** are among most important reactions in azo dyes which account for more than half of the total dye output.

**SULPHONATION** has been a field of chemical activity with amazing advances while direct sulphonation with sulphur trioxide remains dominant.

**HALOGENATION** processes have increased enormously in recent years with a host of industrially important chlorine and fluorine derivatives on the scene.

**AMMONOLYSIS** has reflected the economic impetus of large supplies of ammonia at low and stable prices, with development of many new applications.

**OXO REACTION** for production of aldehydes and alcohols from olefins is a welcome addition to unit processes from I. G. Farbenindustrie.

**OXIDATION** reactions have benefitted from the stimulus of synthetic fiber developments, and the search for commercial routes to acrylonitrile.

**HYDROLYSIS & HYDRATION** processes have seen calculation of thermodynamic functions from molecular data through methods of statistical mechanics.

**ALKYLATION**—many innovations in aliphatics; chemical engineering investigations in the production of high octane gasoline have been extensive.

**ESTERIFICATION**, well established, sees few radical changes, but offers developments in soap-making, ketone and formaldehyde esterification.

**POLYMERIZATION** owes a debt to researchers in England, Germany and the U. S. where significant advances have been recorded in the last two years.

**FRIEDEL-CRAFTS** reactions, long important in dye manufacture, have proved their versatility in the manufacture of styrene and butyl rubber.

# UNIT PROCESSES

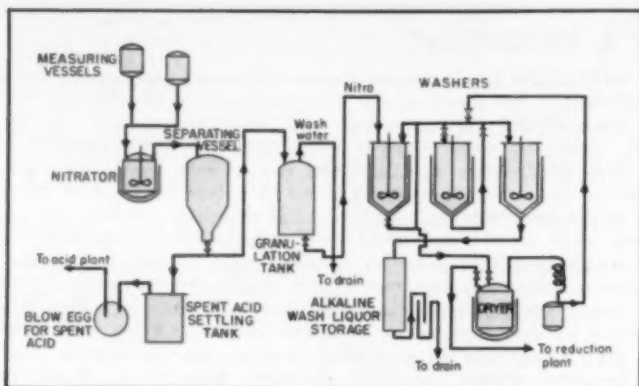
The chemical in chemical engineering refers to unit processes, the engineering to unit operations. Upon each of these is built the great tower of economic strength we have labeled CPI. But lest these become Towers of Babel, we must look to the foundations of the industry, nurturing horizontal as well as vertical growth. With this in mind, we have given the following pages to advances in unit processes.

## CHEMICAL ENGINEERING REPORT—MARCH 1951

**T**HE FIRST preview article on Unit Processes in Organic Synthesis appeared in the May 1934 issue of Chem. & Met. At that time the terms unit processes and unit operations were practically new and it was necessary to distinguish between them as well as to show how they were intimately related to chemical engineering activities involving organic synthesis. Now, almost seventeen years later, these terms have become the alpha and omega of our chemical engineering literature.

This month, Chemical Engineering presents the highlights and recent advances in unit proc-

esses. Space limitations make it possible to present only a few of the highlights from this dynamic and expanding field of chemical activity. The editors hope, however, that the following thumbnail sketches will provide the reader with a refreshing birds'-eye view of what's new in unit processes. For the exposition of the processes we are indebted to the collaborators of the outstanding work in the field: P. H. Groggins' *Unit Processes in Organic Synthesis*, the fourth edition of which is to be published later this year by the McGraw-Hill Book Co. The following pages are based on the new edition.



EXAMPLE: Preparation of 2-nitronaphthalene.

## NITRATION

**NEW:** Much progress in kinetics—basic scientific groundwork for future technologists to tap.

**IMPORTANT:** Latest emphasis on the nitration of aliphatic raw materials—in large quantities.

Primarily military

Although the production of amines has always occupied a high rung on the ladder of chemical economy, military explosives have set the pace for this unit process. Nitration is the cornerstone of the explosives industry. Nitrated compounds suitable for explosives may be true nitro compounds or nitric acid esters.

Latest emphasis has been on the nitration of aliphatic raw materials—in large quantities. Examples: use of pentaerythritol for PETN (pentaerythritol tetranitrate); hexamethylene tetramine for RDX (trinitrotrimethylenetriamine); and acetylene for tetranitromethane.

Industrial nitrations have shown a slow and steady development.

Continuous . . .

In Europe, where the size of charge under going nitration is limited by law, continuous processes are favored. During World War II, Germany used both for the manufacture of nitroglycerine, ethylene glycol dimnitrate, pentaerythritol tetranitrate, and cyclotrimethylene trinitrate. Best known of these continuous facilities are the Schmidt-Meissner continuous nitrator, separator, and washer.

Batch . . . vs. . . .

The U.S. decidedly prefers batch processes, probably because of greater safety and higher yields. One PB report claims a 3 percent higher yield of nitroglycerine by batch processes.

An integrated batch procedure for the production of TNT was developed in the U.S. during the recent war. The acid for mono nitration is a spent acid from bintritation fortified with nitric acid. The spent acid from trinitration is similarly fortified for use in bintritation. New acid is used for the trinitration and consists of 30 to 40 percent oleum which is added to the "bi-oil"; then a mixed acid containing 60 percent nitric acid and 40 percent sulphuric

is added. The toluene and mononitrotoluene are added to the mixed acids at a relatively rapid rate.

A number of investigators have recently studied the mechanism and kinetics of the nitration of aromatics. Among their more significant findings: proof of the long suspected hypothesis that the nitro radical was the active constituent of nitrating agents. Recent kinetic studies have garnered a wealth of data to support the belief that the nitryl ion is formed in strong mixed acids and that its concentration is a rate-controlling factor. Specifically, investigators found that the maximum concentration of nitryl ion was obtained with mixed acids of about 91 percent acidity. Above and below this acidity, concentration diminishes. Therefore, practical operations would best be adjusted to a suitable acidity which would prevail throughout the course of any nitration.

Impact of kinetics

Exceptions, of course, are nitrations which do not involve the presence of strong acids and hence nitryl ions. Some phenols, ethers, and polyhydric alcohols are successfully nitrated with relatively weak acids, and in the case of pentaerythritol, with nitric acid (80 percent) alone. With regard to economic interpretations:

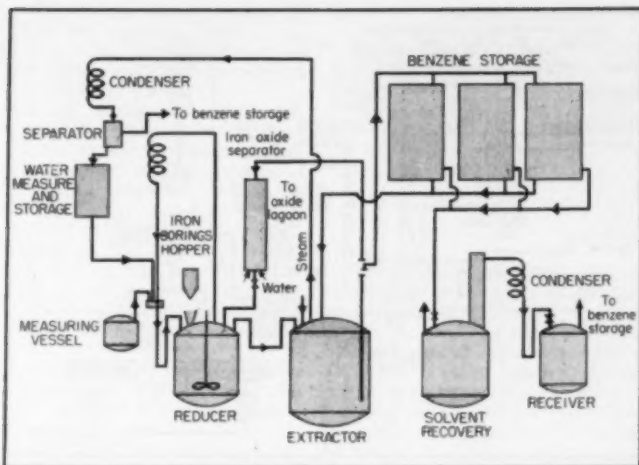
Exceptions

Economics

1. No marked changes in the domestic production of nitro compounds.
2. For the production of amines, amination by reduction of nitro compounds is meeting competition from amination by ammonolysis.
3. The large scale emergency requirement of xylenes as an additive for aviation gas has brought about the production of technical nitroxylenes on an enormous scale.
4. Nitroparaffins have been the subject of many investigations, have found use as solvents.
5. Aldehyde condensation products when nitrated are useful explosives.

Nitration costs depend largely on the procedure used to bind the water of reaction and the regeneration of the dehydrant. Although a number of dehydrants are used, sulphuric usually gets the job because of its low cost, avoidance of side reactions, and moderating effect on the course of nitrations.—P. H. Groggins





EXAMPLE: Solvent reduction for  $\alpha$ -naphthylamine crude.

## AMINATION BY REDUCTION

**NEW:** Large scale use of hydrogen in the presence of a catalyst.

**IMPORTANT:** Explanation of the mechanism of the Béchamp reaction from the viewpoint of electronic theory has led to better understanding of other methods of reduction.

**Methods** The reduction of nitro compounds has been practiced for over a century. The more important methods that have been used for preparation of amines or intermediate products of reduction are:

1. Béchamp reduction: iron and dilute acid
2. Catalytic reductions with hydrogen
3. Alkali-metal reductions
4. Sulphide reductions
5. Sulphite reductions

**Progress** Notwithstanding its antiquity, constant progress has been made in the application of the Béchamp reaction. In many instances acidic salts have replaced hydrochloric, sulphuric, and acetic acids. The reducers have been greatly enlarged and made more corrosion and erosion resistant. Finally, the operations of feeding the charge and recovering the desired amine have been increasingly mechanized. Thus high capacity, low operating cost, and excellent control have been achieved for the batch Béchamp process.

The most noteworthy development in the unit process, amination by reduction, has been the large scale use of hydrogen in the presence of a catalyst. This technique is particularly suitable for the reduction of nitro compounds which can be produced in conjunction with petroleum refinery operations because hydrogen is a relatively cheap reactant at a refinery. In the U. S. catalytic hydrogenation was used for

the reduction of nitroxylenes during World War II, a technique which may again be used on a more permanent basis for the production of amino compounds and motor fuels of improved anti-knock characteristics, or both.

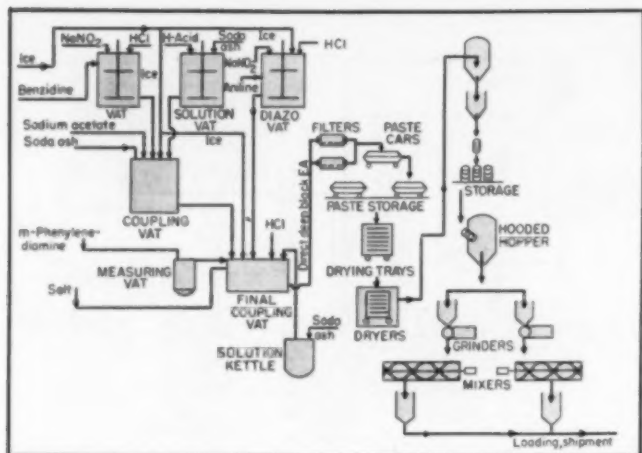
The explanation of the mechanism of the Béchamp reaction from the viewpoint of electronic theory has permitted a better understanding of other methods of carrying out reductions. This new knowledge finds application in improving the efficiency of commercial operations. Thermodynamic data pertaining to vapor-phase catalytic reductions of nitro compounds to primary amines show that the heat of reaction corresponds closely to conversions in the liquid phase by means of the Béchamp reaction.

During the past decade, the domestic production of synthetic ammonia has increased threefold. This assures an adequate supply of ammonia and nitric acid for the preparation of amines by ammonolysis and reduction.

Catalytic reductions are the most readily adaptable to continuous operations and have recognized merit in the large-scale production of individual amines. Such reductions are particularly suited to plants or refineries having a supply of cheap hydrogen. It is to be emphasized, however, that catalytic reductions frequently give rise to over-reduction as well as under-reduction. Recycling of feed stocks is necessary and the yields are not consistently as high as those obtained by the Béchamp reaction. Catalytic operations do, however, permit opportunities for advantageous use of the heat of reduction. In the older segments of the chemical industry, particularly the dyestuffs plants, the Béchamp reaction is accepted as a highly efficient tool. Because a battery of batch reducers makes for almost continuous operations and most importantly for close control of individual reactions, this method is destined to continue to play an important role in the unit operation, amination by reduction.—P. H. Groggins

Béchamp mechanism

Catalytic reduction



EXAMPLE: Preparation of azo dyes.

## DIAZOTIZATION and COUPLING

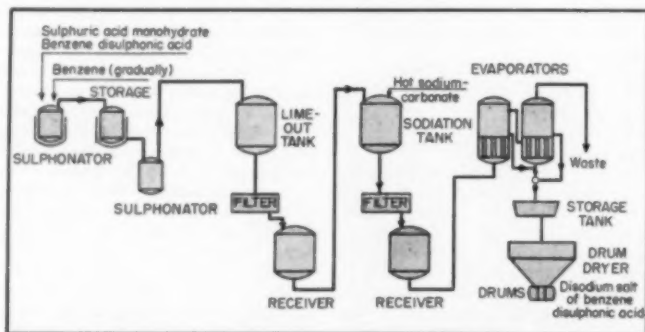
**NEW:** A gradual clarification of the mechanism of the diazotization and coupling reactions is taking place.

**IMPORTANT:** Azo dye production has increased to a new high of over 44 percent of the total dye production.

**Synthetic dyes** The diazotization and coupling reactions continue to rank among the most important reactions in the commercial production of dyes.

The discussion regarding the mechanisms of the diazotization and coupling reactions continues while a gradual clarification of the matter is taking place.

Importance is shown by the fact that while the total production of coal tar dyes in 1948 was 5 percent less than the record output of 1947, azo dye production increased to a new high of over 44,000 tons which was about 44 percent of the total dye production. The average unit value of azo dyes (89¢ per lb.) for 1948 was close to the average for all synthetic dyes (88¢ per lb.)—a median unit value.—Harold Woodward.



EXAMPLE: Preparation of the disodium salt of benzene disulphonic acid.

## SULPHONATION

**NEW:** Widespread adoption of continuous processes.

**IMPORTANT:** Progress elucidating the mechanism of reaction.

Amazing advances have been made in this field of chemical activity in recent years. The

traditional method of direct sulphonation with solutions of sulphur trioxide continues to be the dominant technique. These have also been used to elucidate the mechanism of reaction and for kinetic studies. Other methods of introducing the sulphonic acid group are becoming increasingly important and account for the development of new commercial activities. Some of these methods are: (1) Use of sulphur trioxide in

conjunction with solvents, diluents and as adducts. (2) Use of sulphuryl chloride. (3) Sulphochlorination. (4) Sulphoxidation. (5) Substitution or addition reactions with sulphites and bisulphites (Strecher reaction).

Novel equipment

Development of continuous sulphonation processes has necessitated the design, construction, and operation of novel equipment. Some of these facilities testify to the ingenuity of the chemical engineer when he puts our increased knowledge of unit operations to efficient practice in carrying out the unit process, sulphonation. Many of the new sulphonation techniques are used in the manufacture of detergents. This is not surprising. This field of chemistry was virtually static since biblical times but is now witnessing a phenomenal growth.

Mechanism of sulphonation has been studied by numerous investigators in recent years. The postulates from different schools, particularly British, are on common ground in many particulars, and reflect our increasing knowledge regarding the structure and behavior of atoms and molecules. Some of the more tenable postulates regarding aromatic sulphonation are:

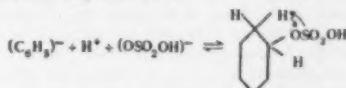
Free radicals

1. Free radical mechanism in which an ion formed by oxidation of aromatic compound splits off a proton thus producing a free aryl group which combines with other free radicals present.



2. Aromatic compounds yield sulphonation products because the reactants form addition compounds which are capable of rearrangement. The addition occurs between a polar resonance form of the aromatic and both an anion and cation of sulphuric acid.

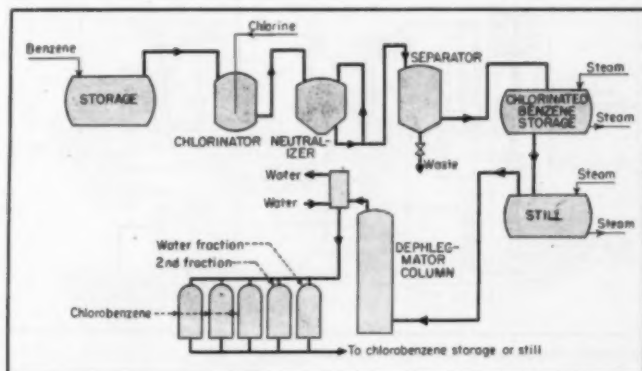
Aromatics



3. Sulphonation involves a cationic mechanism wherein electrophilic sulphur trioxide may react molecularly or in the form of an ion,  $SO_3H^+$ . By attacking the negative center of a polarized form of hydrocarbon, addition occurs (as shown in above equation) followed by expulsion of a proton from the aromatic compound.

Cations

During and since World War II the domestic production of sulphuric acid has increased about 60 percent to about 11 million tons per year. Although the traditional large users of sulphuric acid have steadily increased their consumption, the production of organic sulphates and sulphonates has shown an extraordinary percentage increase. The world-wide interest in surfactants suggests that we may expect new technical developments in this field based on sulphonation operations.—P. H. Groggins



EXAMPLE: Chlorination of benzene.

## HALOGENATION

**NEW:** Enormous commercial expansion of chlorine and fluorine compounds.

**IMPORTANT:** Chlorination of paraffins by thermal and photochemical procedures has increased greatly; extensive development of catalyzed processes; trend to more efficient continuous processes.

Production of halogens and halogen compounds has increased enormously in recent years.

Chlorine derivatives continue to be produced in by far the largest quantities. The manufacturer of chlorine-containing organics, commercially inconsequential ten years ago, now consumes a very substantial portion of our chlorine supply. Included in these new developments are: polychloro pesticides (DDT; chlordane; benzene hexachloride; toxaphene; 2,4-D and 2,4,5-T); vinyl chloride; chlorinated paraffinic and olefinic intermediates; solvents and fumigants; and chloroacetic acid for 2,4-D and carboxymethyl cellulose.

Much progress has been made in fundamental research, development, and production of fluorine compounds. The large wartime use of HF

as an alkylation catalyst in the preparation of motor fuels has greatly declined. The Freons, used in increasing quantities as refrigerants and as propellants for insecticide aerosols constitute the bulk of organic fluorine compounds. The production of tetrafluoroethylene polymers (Teflon) and other derivatives, however, is increasing.

No outstanding commercial expansion has occurred in the fields of bromination and iodination although considerable research has been reported. A comprehensive literature survey on the preparation and use of iodine derivatives is issued periodically by the large-scale producers of this halogen.

The chlorination of paraffins by thermal and photochemical procedures has increased greatly in industrial importance in recent years. By appropriate regulation of temperature in thermal operations, it is feasible to obtain predominantly saturated compounds with mild conditions, and chlorinated olefins—due to dehydrochlorination—at higher temperatures. Conditions for substitutive chlorination, addition chlorination and hydrochlorination, and dehydrochlorinations have now been developed to give consistently high yields of chloroparaffins and chloroolefins.

The kinetics and thermodynamics of chlorination reactions have been extensively studied. Rules for the chlorination of paraffins have been formulated.

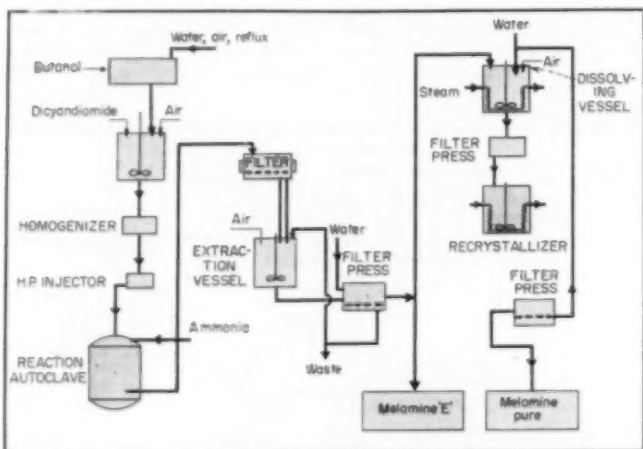
Rate equations for batch and continuous chlorinations of benzene have been derived which permit easy calculation of the ratios of chlorinated products. Other recent studies on the chlorination of benzene show the effect of catalysts, temperature and degree of chlorination on the formation of paradichlorobenzene.

The outlook for continued expansion in the production of halogen derivatives of aliphatic hydrocarbons appears bright because:

1. Chlorine, fluorine and their hydrides are relatively cheap.
2. The paraffins are low-cost feed stocks.
3. The chloroparaffins and chloroolefins have a multitude of direct commercial applications.
4. The chloroparaffins and chloroolefins are readily converted to alcohols, amides, sulphonic acids, etc. which have extensive uses.

The chlorobenzenes, chloronaphthalenes and chlorophenols have also found increasing uses for pesticides and other products.—P. H. Groggin

Outlook



EXAMPLE: Preparation of melamine: Isobutanol process.

## AMMONOLYSIS

**NEW:** In aminolysis—the preparation of *n*-methylaniline by the reaction of methylamine with chlorobenzene. In ammonolysis: the treatment of aromatic and aliphatic hydrocarbons, including olefins and naphthenes, in the vapor phase and in the presence of an oxidation catalyst supported on alumina.

**IMPORTANT:** Amines, amino acids, and amides are becoming increasingly important in the preparation of dyes, detergents, drugs and fibers.

Cheap  
ammonia

Availability of enormous supplies of ammonia at relatively low and stable prices has encour-

aged the development of many new applications, and the expansion of old applications of this unit process. With regard to the well established reactions (replacement of aliphatic and aromatic halogen, replacement of aromatic sulphonic acid groups and conversion of alcohols) there has been a steady improvement in the control of operations. Marked progress has been made in the hydroammonolysis of aldehydes, ketones, and carboxylic acids. Hydroammonolysis can also be used in the vapor-phase conversion of alcohols in the presence of a nickel catalyst. Using this technique, butyl alcohol gives a mixture of primary, secondary and tertiary butylamines with only 2.4 percent of butyronitrile. In the absence of hydrogen, the butyronitrile content is 45 percent.

A notable development in aminolysis involves the preparation of *n*-methylamine by the reaction of methylamine with chlorobenzene. The most striking advances in ammonolysis involve the treatment of aromatic and aliphatic hydrocarbons, including olefins and naphthenes, in the vapor phase and in the presence of an oxidation catalyst supported on alumina. Toluene and xylenes when thus treated at about 450 deg. C. yield benzonitrile and tolunitrile respectively. Propane and butane give principally, acetonitrile. Acetonitrile is obtained also in high per pass yields from ethylene, propylene and butane.

Physical  
vs.  
chemical

The use of continuous processes instead of batch operations is being expanded in the production of amines that can be purified by physical rather than chemical means. In the preparation of nitroanilines, the I. G. Farbenindustrie developed a continuous process in which the parent chloronitrobenzenes were passed through a reaction coil of the hairpin type.

Copper  
catalyst

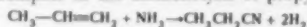
In the ammonolysis of halogen compounds, a copper catalyst is generally used and this is customarily recovered by precipitation and filtration. A scheme to obviate these steps involves separation of the organic layer containing aromatic amine, e.g., methylamine, and controlled neutralization of the aqueous ammoniacal solu-

tion of the amine hydrochloride (methylamine) or ammonium chloride with sodium hydroxide. The neutralization is carried to a point where most of the reactant amine or ammonia is liberated but the copper still remains in solution and can be returned to the process.

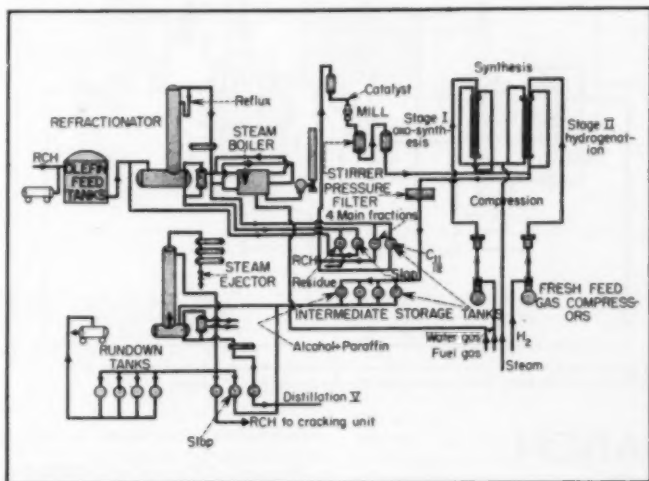
The relation between ammoniacal ratio to lower alcohols in the formation of primary, secondary and tertiary alkylamines has been studied extensively. The repression of any particular amine by reintroduction to the reaction system is finding increasing practical application. The ethanalamines derived from ethylene oxide and ammonia behave similarly. By returning the undesired amine to the system, the equilibrium is shifted to exclude its further formation.

Most ammonolytic reactions are second order reactions and are exothermic. The reaction of ammonia with hydrocarbons is endothermic and complex. The following reactions, for example, compete in the ammonolysis of propylene.

Propylene



—P. H. Groggins



EXAMPLE: Preparation of alcohols from olefins.

## OXO REACTION

**NEW:** One-stage production of alcohols has been shown to be practicable.

**IMPORTANT:** It has been shown that the reaction is applicable to aldehydes, ketones and to sulphur-containing compounds.

The Oxo process for the production of aldehydes and alcohols from olefins by reaction with

hydrogen and carbon monoxide has stimulated considerable interest and some industrial activity during the past five years. Only a few articles on the basic chemistry of the reaction have appeared in the usual chemical literature but many patents on the process have already been issued and it is certain that a great many more are being processed. The first commercial exploitation in this country and England appears to be concerned with preparation of eight-and-nine-carbon-atom primary alcohols for use in the manufacture of plasticizers. The starting olefins are those, like



diisobutylene, which are available to petroleum processing concerns.

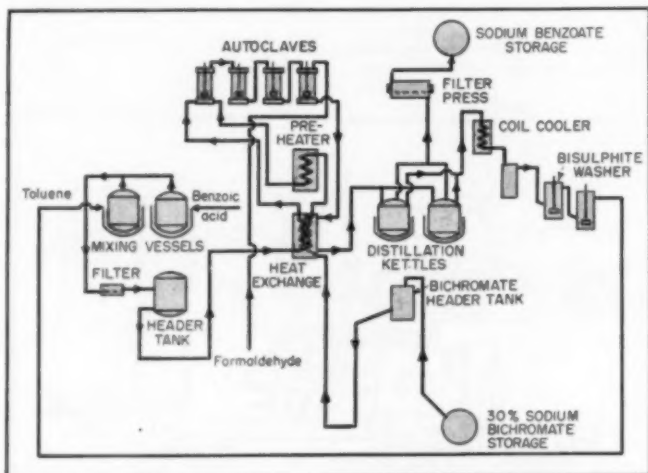
Because of the present highly competitive status of the Oxo reaction, process developments in this country have not as yet been revealed. Indications are that, in general, the two-stage process operated by the Germans is being used.

**Catalysis** It has been quite firmly established that either dicobalt octacarbonyl or cobalt hydrocarbonyl is the active catalyst and that these compounds are readily formed from any salt of cobalt or from the activated metal. Special Fischer-Tropsch catalysts are necessary or even desirable. There are some advantages (such as lower reaction temperature) to using pre-formed dicobalt octacarbonyl as the catalyst.

**Chemistry** Basic research on the chemistry of the Oxo reaction being conducted at the U. S. Bureau of Mines has led to some valuable developments. These include: (1) the one-stage production of alcohols by using fairly large cobalt concentrations and higher-than-usual temperatures; (2) the hydrogenation of aliphatic aldehydes and

ketones to alcohols and of aromatic ketones and alcohols by hydrocarbons under Oxo conditions; (3) evidence that the hydrogenation reaction is homogeneous, and therefore, applicable to sulphur containing compounds; (4) the homologation reaction by which methanol can be converted to ethanol; benzyl alcohol to 2-phenyl ethanol and tertiary butyl alcohol to isomyl alcohol.

The Oxo process has not been in operation long enough to evaluate its impact on the chemical industry. It is likely that the reaction will receive consideration wherever large quantities of any kind of olefins are available. The olefins of interest not only include those in cracked gases, alkylation byproducts and Fischer-Tropsch oils but other materials such as the terpenes and unsaturated fats and oils. Certain alcohols may conceivably be used profitably as starting compounds. A more complete study of the reaction may lead to important modifications that will also be useful in synthetic organic chemistry.—  
William G. Schroeder and Milton Orchin



EXAMPLE: Bichromate oxidation process for the production of sodium benzoate.

## OXIDATION

**NEW:** Major commercial interest has been directed at manufacture of acrylonitrile for use in synthetic fibers.

**IMPORTANT:** Acrylonitrile, in turn, has stimulated interest in ethylene oxide.

**Celanese leads** A number of industrially significant developments have occurred in the field of organic oxidations in recent years. Some of these have been financially successful but at least one commercial effort at manufacture of oxygenated hydrocarbons based on natural gas and oxygen has had trouble showing a profit. So far, no other commercial venture has been able to compare with the outstanding development of hydro-

carbon oxidation performed by Celanese Corp. at its Bishop, Tex. installation.

Production of synthesis gas by the incomplete burning of natural gas with oxygen at the installation of Carthage Hydrocol at Brownsville, Tex., is now approaching commercial operation after months of construction and testing. The performance of the very large tonnage oxygen plant as well as that of the partial combustion units will be watched with considerable interest.

Major commercial interest has been directed at manufacture of acrylonitrile for use in synthetic fiber developments such as Du Pont's Orlon, Carbide's Dynel, and the joint Monsanto-American Viscose development of Chemstrand. Present manufacture of acrylonitrile by American Cyanamid is based on ethylene oxide and although considerable experimental work has

Synthesis  
gas

been done on the acetylene route, some interest still exists in the possibilities of the ethylene-oxide route. This, of course, has created further interest in ethylene oxide itself as an important intermediate for products other than glycol, non-ionic detergents, and other derivatives.

**Ethylene glycol**

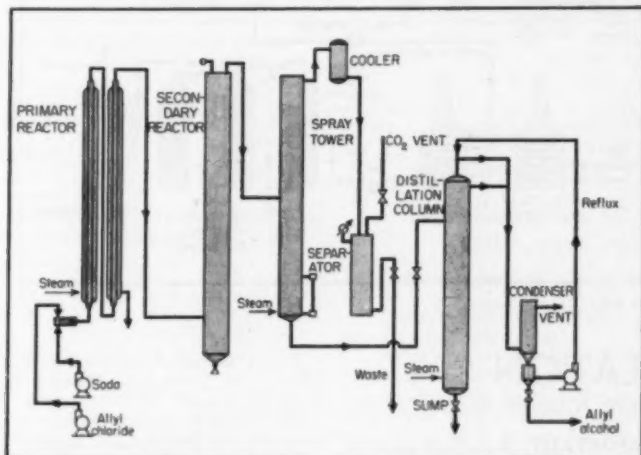
Ethylene glycol production is being expanded from some 350 million pounds per year to some 500 million pounds and an accompanying expansion is occurring with ethylene oxide to supply the increasing demands for this important intermediate. A portion of this expansion is via the direct oxidation route.

Interest is still high with respect to the possible commercial production of acetylene from petroleum hydrocarbons by routes which include pyrolysis, incomplete combustion, or combina-

tions applied to natural gas hydrocarbons. The presumption is that commercialization of some one of these processes for producing petroleum-based acetylene may be achieved in the near future in connection with manufacture of acrylonitrile for synthetic fibers and synthetic rubber.

The chemical industry is watching with interest the Mathieson Hydrocarbon Chemical Co.-Tennessee Gas Transmission Co. project for production of petrochemicals at Brandenburg, Ky., since it may point the way for other petrochemical developments at locations remote from the southwestern natural gas sources. However, it is too early to forecast whether other ventures based on pipeline natural gas will be undertaken.—L. F. Marek

**Petrochemicals**



EXAMPLE: Preparation of allyl alcohol.

## HYDROLYSIS (and Hydration)

**NEW:** Production of ethanol from ethylene in the presence of a solid catalyst, and glycerine from propylene via allyl chloride.

**IMPORTANT:** Calculation of thermodynamic functions from molecular data through the methods of statistical mechanics.

**Ethanol**

The production of Ethanol from ethylene in the presence of a solid catalyst, and glycerine from propylene via allyl chloride are probably the two most important recent developments.

Through a continued effort toward placing hydrolytic reactions on a basis derived from first principles, distinct advances have been made in theory of reaction mechanisms. Well known industrial processes and comparatively new reactions have been repeatedly studied from the theoretical approach. However, to obtain a clearer

view of the effect of varying conditions, the thermodynamics and kinetics of these reactions are still studied separately.

In addition to the classical methods, recent years have seen the calculation of thermodynamic functions from molecular data through the methods of statistical mechanics. This has greatly increased the availability and usefulness of thermodynamic data and has aided materially in the solution of thermodynamic problems. The excellent agreement between observed and calculated values for the free energy of hydration of ethylene serves as an example.

Although most reaction rate data are interpreted in terms of a modified Arrhenius equation, the newer theory of absolute reaction rates has been applied in many cases. The effect of pressure on the rate of reaction is shown by the following relationship from the transition state theory

$$\frac{d \log_e k}{dP} = \frac{-\Delta V}{RT}$$

**New twist**

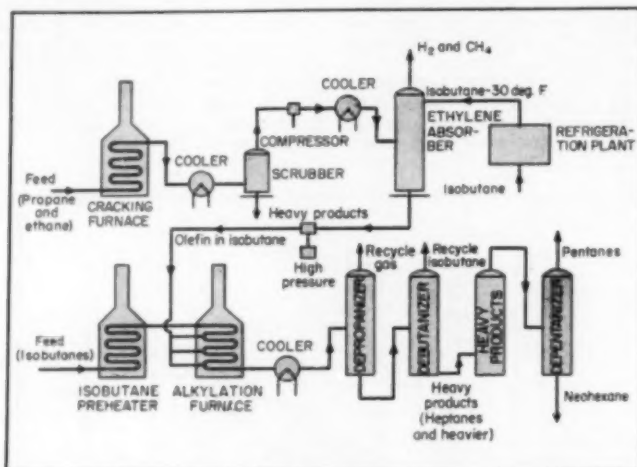
**Reaction rates**

where  $\Delta V$  is the change in volume between the reactants and the activated complex.

For the saponification of ethyl acetate over the pressure range 250 to 500 atm. the calculated value for  $\Delta V$  is  $-11$ .

Thus the rate should increase with increased pressure. This is in agreement with experiment, though the observed value is somewhat smaller.

This new theory affords a means of calculating kinetic data from first principles, thus performing the same service as statistical mechanics has performed for thermodynamic data. There is still much progress to be made, but even the present results should attack the problems of hydrolytic reactions with less arbitrariness.—Stewart J. Lloyd and W. F. Hamner.



EXAMPLE: Thermal process.

## ALKYLATION

**NEW:** Hydrogen fluoride alkylation.

**IMPORTANT:** Industrial activity reflected in work on ethyl benzene, CMC, silico-organics, mercury alkyl derivatives, and TEL.

HF process

During recent years developments in alkylation were largely in the aliphatic field. Chemical engineering investigations in the production of "Alkylate" required for high octane gasoline, have been extensively pursued. Out of this has come the development of the relatively economic hydrogen fluoride process for the making of alkylate which gives a product with advantageous properties. Hydrogen fluoride alkylation is carried out at room temperature and under ordinary pressure. This means a less expensive plant compared with thermal alkylation which is carried out at high temperature and high pressure, or with sulphuric acid alkylation under conditions of only slight refrigeration. Lauryl mercaptan and tertiary mercaptans derived from petroleum, are aliphatic alkyl compounds that have been investigated for their application as modifiers in the making of synthetic rubber. Lauryl mercaptan is now made on a large scale from lauric acid after stepwise conversion to lauryl chloride. This is then converted to mercaptan by reaction with sodium acid sulphide in an autoclave.

A very important alkylation product, ethylbenzene, is in increased demand because of needs for styrene. With respect to this compound, studies by physical chemists of equilibria constants, the free energies, heats of formation and other basic properties of the various alkyl derivatives of benzene have resulted in the development of efficient operations in this unit process.

The cellulose field has received continued attention by research organizations. One significant development relates to CMC (sodium carboxymethylcellulose) a product having many industrial uses and promise for many more uses as time goes by.

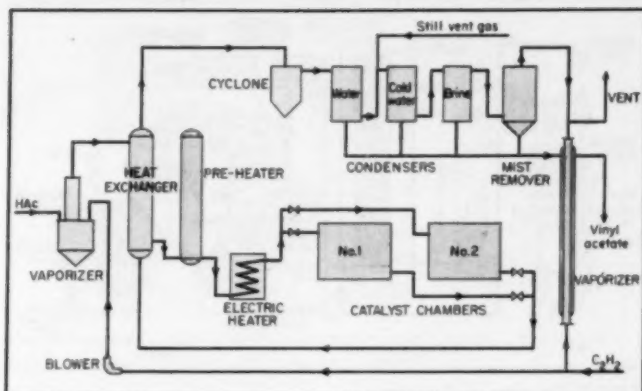
CMC

A new development of importance is the introduction on a commercial scale of the various silico-organic compounds. Their introduction to industry, as the basis for highly stable surface coatings, oils, fluids and resins, has been almost sensational.

Mercury alkyl derivatives in the form of either ethyl mercury chloride or ethyl mercury phosphate, are finding increased applications as seed and other disinfectants. These derivatives are usually mixed with talc to form dusting powders.

Tetraethyl lead has reached a stage of maturity in its commercial development now that the basic patents have expired, thus permitting competition in its manufacture. As frequently occurs in such instances more data appear in the literature in the form of patents.—R. Norris Shreve

TEL



EXAMPLE: Preparation of vinyl acetate.

## ESTERIFICATION

**NEW:** Improvements in soap-making; use of ketene to do jobs acetanhydride cannot do.

**IMPORTANT:** Consideration is being given to continuous xanthation processes.

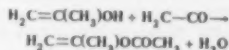
In esterification, large and well-established radical changes are rare. Those changes that do develop, are mostly operational details of old processes. The details of the processes vary from time to time and from plant to plant, are usually kept secret as long as they are of private advantage. In fact, there is no absolutely best way to make any one ester such as ethyl acetate; an experienced and skillful operator can determine the most economical method for a certain scale of operation to produce a specified grade of ester with acetic acid, alcohol, and steam at certain prices, but, for another scale or with materials at other prices, an entirely different process may have the advantage. Anyone with a thorough understanding of the principles can apply them to special cases as they arise.

Meanwhile, tons and tons of esters are being turned out, some of them new, others the product of improved processes.

**Soap** There is one important large-scale innovation in soapmaking which, basically, has remained the same since the old Roman days when Pliny described it, even though a modern kettle can turn out a million pounds of soap at a run. The improvement is this: in a new Procter and Gamble plant, fats are being hydrolyzed when brought in contact with superheated water running countercurrent in a tall tower. The liberated fatty acids are separated and neutralized with sodium hydroxide.

**Ketene** Two recent items which are interesting—though in the early stages of development—have to do with ketene. In both of these, ketene does a job which acetanhydride cannot do. It has been known for a long time that the esterification of the enol form of an aldehyde does not go

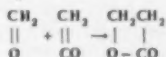
very well. For this reason, it has received little attention. Recently, however, it has been found that ketene esterifies not only aldehydes, but ketones also. Therefore, writing acetone in its enol form, we have



The product, isopropenyl acetate, is interesting in several ways:

1. It polymerizes by itself and copolymerizes with other vinyl monomers.
2. As an ester, it undergoes acidolysis to form isopropenyl esters of other acids.
3. By alcoholysis an alcohol may replace the acetone and, what is novel, an aldehyde may do the same, opening the way for the preparation of quite a variety of enol esters.

Ketene esterifies formaldehyde also. Here,  $\text{CH}_2\text{O}$  there is no possibility of an enol ester. The product is  $\beta$ -propiolactone

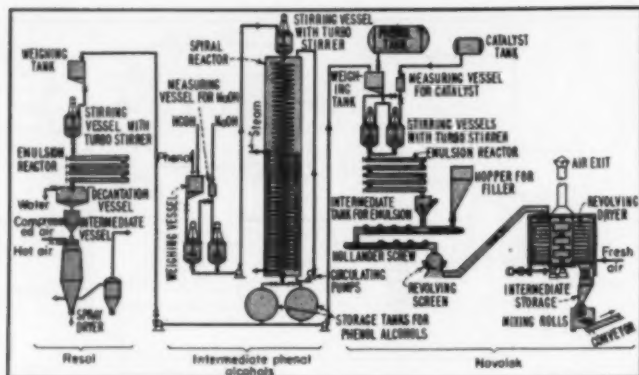


This four membered ring, is highly reactive and can be used in a variety of syntheses. It polymerizes to poly-ester acids, which have a carboxyl group at one end of the chain and a hydroxyl or vinyl at the other. It combines with an alcohol to form an ester of hydricrylic acid.

After what seems to an outsider a long time, the viscose people are giving more consideration to continuous xanthation processes, for example, cellulose xanthate is made in enormous quantities—tens of thousands of tons annually—as an intermediate in the manufacture of rayon and Cellophane. Plans are being drawn by Du Pont for a plant to be located on the Neuse river, near Kinston, N. C., for the manufacture of Fiber V, the polymeric glycol ester of terephthalic acid.

Fiber V, newest of the synthetic fibers, has high tensile strength, wet as well as dry, and other interesting properties that promise to make it important. Fiber V illustrates a new use being made of an ester.—E. Emmet Reid

Reactive



EXAMPLE: Preparation of phenolic resins.

## POLYMERIZATION

**NEW:** Aromatic molecules containing two methyl groups in the para or ortho position can be polymerized by dehydrogenation at high temperatures.

**IMPORTANT:** Progress in kinetics by measuring the absolute rate constants of the different steps and the average lifetime of the different free radicals involved in these reactions.

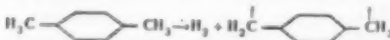
Among the organic and inorganic substances with which the chemist and chemical engineer have to deal is a group of materials that, although differing greatly in physical and mechanical behavior, show certain common properties and thus can be distinguished rather clearly from the ordinary chemical compounds.

The very desirable mechanical, electrical, optical, and thermal properties of these polymeric materials has led to their intensive study during the last three decades.

During the last two years some important progress was made in the field of polymerization.

England

In England, M. Szwarc found that aromatic molecules containing two methyl groups in the para or ortho position can be polymerized by dehydrogenation at high temperatures. If one leads xylene through a quartz tube at temperatures between 700 and 800 deg. C, hydrogen is split off some of the molecules and a reactive biradical is formed.



In the gaseous phase this molecule does not polymerize but as soon as it is condensed on a cool wall, a tough, transparent film is formed which melts only above 350 deg. C. and is completely insoluble in all solvents. It can be dissolved in high-boiling hydrocarbons above 300 deg. C. According to x-ray and infrared investigations, the material consists of linear macromolecules of polyparaxylene. Being a polyhydrocarbon it is highly resistant to any chemical attack and has very interesting electrical properties.

It has been found by Tedder in England that trifluoroacetic anhydride and heptafluorobutyric anhydride are dehydration agents of such strength that high melting polyesters can be formed with their aid, which cannot be prepared by the elimination of water by heat or by ester inter-charge. For example, the self polyester of p-hydroxybenzoic acid can be prepared in 15 hr. at 80 deg. with trifluoroacetic anhydride as water-eliminating agent.

Hoff in Germany has shown that the telomerization of ethylene polymerization with chain transfer agents such as sulphuric acid, chloroform or carbon tetrachloride leads to aliphatic alcohols, carboxylic acids and omega hydroxycarboxylic acids with 20-100 carbon atoms in the aliphatic chain. The interruption of full scale vinyl polymerization with chain transfer agents seems to offer very interesting possibilities to prepare substituted and unsaturated aliphatic alcohols and acids by the use of propylene, isobutylene, styrene and butadiene as monomers, viz., comonomers.

Germany

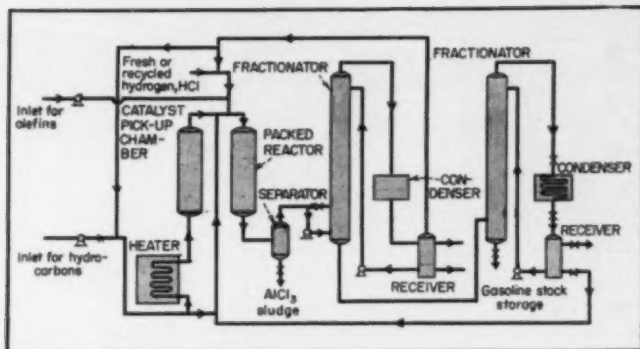
Bailey in this country prepared polydimethylene acetylene with the aid of a bifunctional Grignard reagent. The polymer is a crystalline, high melting, difficult-to-dissolve material with high chemical resistance and interesting electrical properties.

USA

Important progress has been made, in this country, in the low temperature polymerization and copolymerization of vinyl derivatives in emulsions. Highly substituted aromatic hydroperoxides are preferentially used as "catalysts," ferrous salts of organic acids as activators. It has been found that diazothio ethers act as activators and modifiers simultaneously. The emulsion polymerization of butadiene at moderate temperatures (20-30 deg. C.) has led to a rubber of remarkable properties and a host of interesting uses.

Interesting progress has been made in the kinetics of polymerization and copolymerization reactions by measuring the absolute rate constants of the different steps and the average life time of the different free radicals involved in these reactions.—Herman Mark and William P. Hohenstein





EXAMPLE: Alkylation of isoparaffinic hydrocarbons with olefins.

## FRIEDEL-CRAFTS

**NEW:** Versatility of Friedel-Crafts reaction has been shown by its use in the production of styrene from ethylene and benzene and in the manufacture of butyl rubber, as well as its employment in several other important reactions.

**IMPORTANT:** Studies and discussions of the mechanism of Friedel-Crafts reactions have been a proving ground for theories regarding the mechanism of all chemical reactions.

**New uses** For a score of years, starting with World War I, the American dye industry was the backbone of our synthetic organic chemicals industry. The use of Friedel-Crafts condensations for the manufacture of vat dyes was a major factor in the healthy development of our dye industry. With the waning economic importance of dyes with respect to the total output of all synthetic organic chemicals, new developments have occurred to emphasize the versatility of the Friedel-Crafts reaction. In recent years the production of styrene from ethylene and benzene, and the manufacture of butyl rubber have taken the spotlight as examples of condensations made possible by the catalytic activity of metal halides.

**Alkanes** One of the most important developments in recent years has been the use of Friedel-Crafts catalysts for the isomerization of alkanes. This has made possible the production of high-octane fuels so necessary in peace and war.

During the past decade new forms and combinations of metal halides have been developed, particularly by the petroleum industry for use as fluid catalysts in isomerization and alkylation reactions. Continuous processes were developed to carry out these reactions. Techniques for recovering spent catalyst and handling hydrogen chloride were greatly improved.

The need for styrene for the GRS program proved to be a powerful stimulus to chemical engineers to develop continuous alkylation operations in which the degree of alkylation was closely controlled. The production of polyisobutylene necessitated the development of new techniques for low temperature reactions.

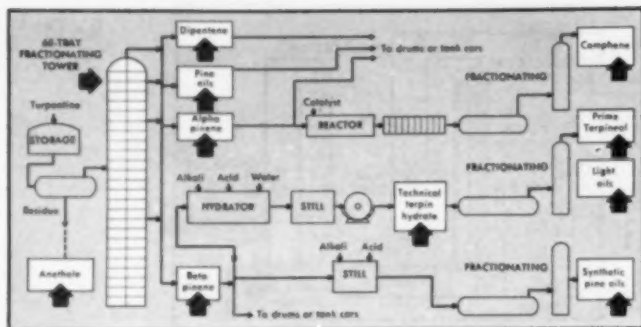
Studies and discussions of the mechanism of Friedel-Crafts reactions have been a proving ground for theories regarding the mechanism of all chemical reactions. New research continues to confirm that in Friedel-Crafts reactions involving acyl and alkyl halides, addition complexes are formed that may be regarded as coordination compounds containing the anion  $(AlCl_4)^-$ . Thermodynamic studies have been made and the heats of formation of aluminum chloride complexes with organic compounds have been determined. Studies on the effect of solvents indicate that efficient solvents make possible a smaller solvent ratio, increased yields, higher purity of product but do not significantly influence the proportions of isomers.

Considering the multitude of useful syntheses made possible by the catalytic activity of aluminum chloride and other metal halides, it is certain that there will be continuing commercial developments involving the Friedel-Crafts reaction.—P. H. Groggins

### ABOUT OUR AUTHORS

If a man is no better than his information, our report is tops—because our authors are. From government, industry and education they have observed, studied and reported. To each of them goes our thanks for a job well done. Our special thanks to *Chemical Engineering's* friend of many years, Phil Groggins, whose friendly advice and cooperation made a difficult job a pleasure. The list of authors follows:

L. F. Marek.....	Oxidation
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W. F. Hamner.....	Hydrolysis
William C. Schroeder	
and Milton Orchin..	Oxo process
R. Norris Shreve....	Alkylation
Harold Woodward...	Diazotization & Coupling
Herman Mark and	
William P. Hohen-	
stein .....	Polymerization
P. H. Groggins.....	Nitration; Sulphonation;
	Ammonolysis; Amination
	by Reduction; Halogenation.
	Friedel-Crafts.



These ten chemicals are produced by the 65-tray fractionating column.

## Closer Fractionation Finer Chemicals

Crosby Chemicals puts in the first  
65-tray fractionating column in its industry. Why?  
To get turpentine products that are purer.

JAMES A. LEE

Closer fractionation of raw materials gives final products of greater purity; that's axiomatic. So engineers at Crosby Chemicals, Inc., put up a tower with double the number of trays common to the naval stores industry. It was designed and installed by Struthers Wells Corp. for Crosby's chemical plant at Picayune, Miss.

### A BIG TOWER

The new fractionating tower is 120 ft. high and has 65 trays. It was designed for separating alpha- and beta-pinenes to 99.5 mol percent purity—something difficult to do with the 30 to 33-plate columns generally used in naval stores plants. Crosby also uses it for separating and purifying other chemicals (see diagram).

Five vapor outlets were placed on different plates of the column. These permit a very flexible operation using from 16 plates on up to all 65. Type 304 stainless steel was used throughout in the construction of the column

JAMES A. LEE, our Southwest Editor, took a "vacation" trip through Mississippi last month. He brought back the story of this new development in the naval stores industry.

and reboiler. Results with the column have been highly satisfactory.

The entire column is used to separate close boiling components—such as the pinenes—from purified and distilled sulphate turpentine. For higher boiling fractions where separation is not so difficult vapor lines can be cut in to lower trays.

Raw material at Picayune is crude sulphate turpentine obtained from kraft pulp mills in the South. It arrives at the plant in railroad tank cars, is unloaded by steam reciprocating pumps and transferred to a steel batch still for primary fractionation. Here the turpentine is distilled under vacuum to remove the light ends—dimethyl sulphide and other materials that are low-boiling and have objectionable odors. The front ends are recycled and a portion of them is burned under the boilers. The batch still also separates the foos or distillation residue or both.

Main portion of the distillate is chemically treated to remove the remaining odors. It then goes to storage in outdoor steel tanks.

The tall fractionating column is charged with turpentine from this storage. Discharge from the steam

jectors is tied into a separator in order to recover the oils that come out of the jets so as to prevent distillation losses.

### FOR BETTER PRODUCTS

Vapors may be removed at the 48th, 32nd, or 16th trays. In these fractionations the products consist of alpha-pinene, beta-pinene, dipentene and pine oils. Beta-pinene is used to produce terpin hydrate, prime terpinol and synthetic pine oil. Alpha-pinene is sold as such or converted into camphene.

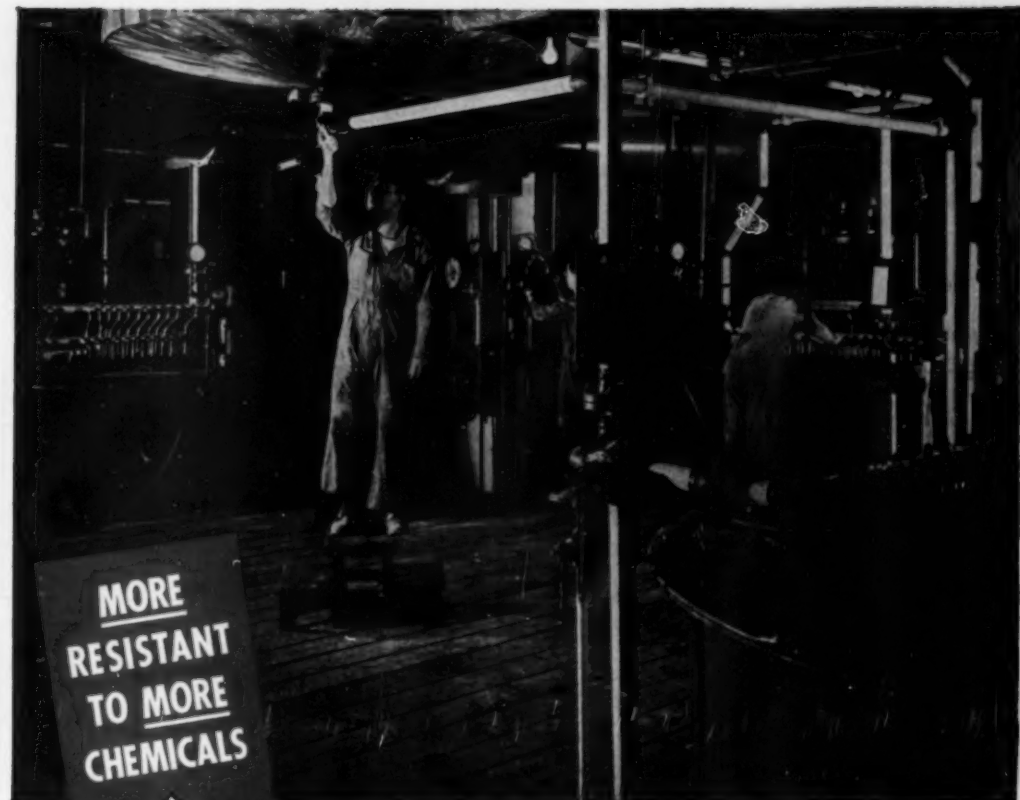
In producing terpin hydrate and prime terpinol, the beta-pinene is charged to a lead-lined hydrator where it is treated with water and a mineral acid; this converts it into terpin hydrate. After the reaction is complete the weak acid layer is drawn off. The terpin hydrate is neutralized with alkali and pumped to a Type 316 stainless steel still where the hydration oils are removed by steaming. Terpin hydrate is then pumped to a 304 stainless steel centrifuge. Here it is centrifuged and washed; the product is technical grade terpin hydrate.

This material is either sold as such or further processed into prime terpinol by transfer to a Type 316 stainless steel still and kettle where the terpin hydrate is then refluxed with a weak acid. After the reaction is complete the weak acid layer is removed. The crude terpinol is neutralized with alkali and charged to the fractionating column where the prime terpinol is separated from the crude. It is used in the perfume industry.

Beta-pinene is charged to a Type 316 stainless steel reactor and treated with a mineral acid and water for direct conversion to synthetic pine oil. When the reaction is complete the weak acid layer is drawn off and the crude pine oil neutralized with an alkali. It is next charged to the fractionating column where the finished synthetic oil is separated from the crude material.

For camphene production, the Type 316 stainless steel reactor is charged with alpha-pinene; catalytic isomerization converts it into camphene. The crude product is filtered in an aluminum plate-and-frame press, then charged to the fractionating column. Here the technical grade camphene is distilled off from the crude. Camphene may be used as an intermediate in the production of synthetic camphor, insecticide and other chemicals.

Anethole is obtained by processing and distilling the still residues. The crude anethole is then fractionated for the production of the technical grade product.



**MORE  
RESISTANT  
TO MORE  
CHEMICALS**



**HARD RUBBER  
AND PLASTICS**

## **HOT CORROSIVE SALTS almost too hot to handle**

**F**OUR TIMES A DAY, metallic salts in hydrochloric and hydrofluoric acid solutions are heated to a near boil and cooled to room temperature, in these digesters and crystallizing tanks. The hot acids are extremely corrosive, and the constant change of temperature is rough on the tanks. Most materials would not stand up or would be too expensive.

Best answer was found in ACE hard rubber linings—the two-layer protection that is both chemically strong, and mechanically tough. Approximately 40 ACE rubber-lined tanks are now in service in this plant. Many have been on the job for eight years.

The fume ducts in the background, incidentally, handle hydrofluoric acid vapors. They, too, are ACE protected.

ACE hard rubber resists all alkalis, metallic salts, inorganic acids, hydrochloric acid any strength, nitric acid to 16° Be, sulphuric acid to 50° Be, phosphoric acid to 75%, and countless other corrosives. Other ACE plastics extend this range still further. Ask for catalogs of ACE-Clad and ACE-molded chemical equipment.





**AMERICAN  
HARD RUBBER  
COMPANY**

11 MERCER ST. • NEW YORK 13, N. Y.

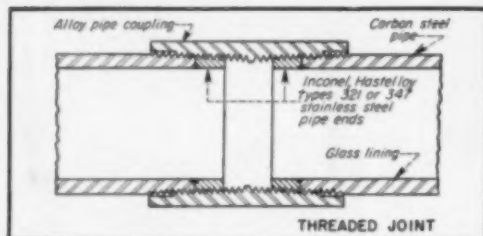


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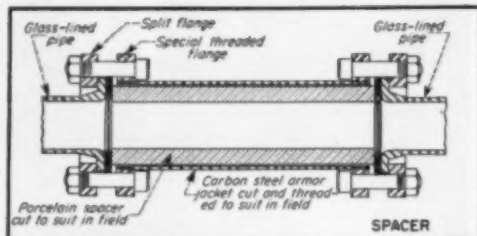
## MORE INFORMATION . . .

To learn more about any item described here, circle the item number on the Reader Service Postcard inside the back cover.

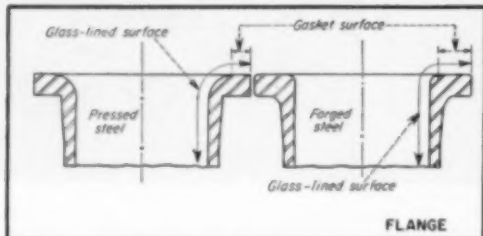
### PIPE, VALVES, & FITTINGS



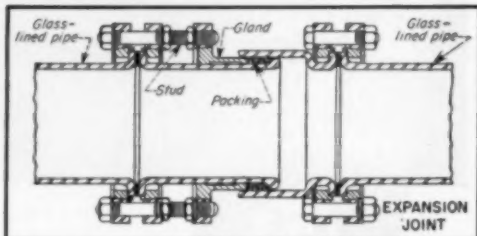
THREADED JOINT



SPACER



FLANGE



EXPANSION JOINT

## Broader Horizons for Glass-Lined Piping

**Recent developments by Pfaudler provide practical solutions to some of the tough problems associated with glass-lined piping jobs.**

Applications of glass-lined piping have always been handicapped by very practical limitations as to serviceability, strength, space, and the necessity for precision-engineered piping layouts. Within the past year, however, Pfaudler Co. engineers have developed some new ideas into workable solutions to some of these problems. As a result, the field of practical application of glass-lined piping can be expected to expand. The above drawings and this discussion describe some of these developments.

### THREADED JOINT

(144A) Glass-lined piping connections have heretofore been exclusively of the vanstone flange type. While this was acceptable in many cases, certain services required the use of couplings rather than large flanges. The new Glassaloy joint permits the use of alloy couplings while preserving the inherent corrosion resistance of glass-lined pipe.

In this scheme, short alloy rings are welded to each end of lengths of steel pipe. Glass lining is applied by conventional means, terminating at the ends of the alloy rings. The pipe is then threaded with standard dies and may be connected by fittings of any alloy which possesses adequate corrosion resistance. Because the ends of the alloy rings are exposed to the

corrosive medium, this ring material must be selected for its resistance to chemical attack. The alloys currently offered cover the majority of service requirements. Glassaloy construction is now available in 1½ to 3 in. I.P.S. and in lengths up to 10 ft. A greater variety of sizes will probably be offered as markets develop.

### FLANGE

(144B) Conventional vanstone flanges have heretofore been pressed from low carbon rimmed steel plate. While these flanges were satisfactory from the ceramic standpoint, they were mechanically weak, and flange radii were so large that relatively little flat area remained for gasket seats.

A practical solution to these limitations was made possible by the ad-

vent of improved forging steels and techniques. Accordingly, the entire line of flanges for glass-lined piping has been redesigned to take advantage of these improvements. The new forged steel flanges of low carbon fully killed steel have smaller radii and larger outside diameters, which result in a significant increase in flat area. Metal thickness through the faces and necks has been increased, thus adding to mechanical strength.

#### SPACER

(145A) A serious limitation to use of glass-lined pipe has been inability to produce makeup lengths in the field. This drawback has demanded complete and precise engineering of piping layouts prior to order placement. Errors of closure or last-minute revisions have often resulted in delays while additional sections of pipe were being fabricated. A newly developed porcelain spacer which can be field cut to any length answers this problem.

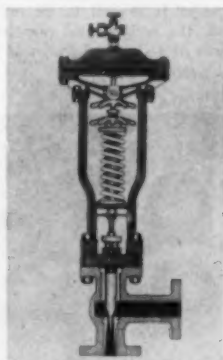
Essentially, the new adapter consists of a stock length of porcelain pipe, a light wall steel jacket, and two threaded steel flanges. The porcelain spacer can readily be field cut to the required makeup length. The steel jacket is cut and threaded on a standard pipe machine, flanges are assembled, the jacket is slipped over the porcelain spool piece, and the assembly is installed between mating flanges of the glass-lined pipe. The steel jacket protects the porcelain spacer during installation and while in service. Inasmuch as the porcelain spool piece is under compression, bolt loads sufficient to insure a tight seal are not very likely to cause breakage.

#### EXPANSION JOINT

(145B) For installations subjected to alternating thermal stresses, a glass-lined expansion joint has been developed which permits linear motion of  $\pm \frac{1}{2}$  in. It consists of a flanged glass-lined male section of the appropriate pipe size, a flanged glass-lined female section whose internal diameter is belled out, suitable packing, packing gland, and special studs. Principal use of this joint has been in vertical columns; however, with suitable hanger supports it should be adaptable to horizontal lines.

(145C) Improvements have also been made in material and design of glass-lined cast iron fittings (not illustrated). Flanges of the new cast iron fittings have been altered to correspond with those of the new forged steel pipe flanges, and foundries are now producing these castings in high strength irons. Currently under in-

vestigation as a material for cast fittings are the even newer ductile or nodular cast irons. If this program is successful, objections to brittle materials in pipelines will substantially evaporate.



NO DIRECT IMPINGEMENT:  
**Regulating Valves**

(145D) The Swartwout Co. has announced a line of flow regulating valves designed to handle steam and water at high pressure drops, and especially flashing condensate. The valves are designed to eliminate direct impingement and thereby reduce the effects of corrosion and erosion.

All internal parts of these valves are made of stainless steel which has been heat-treated and ground to precision fit. Valves are supplied in seven pipe sizes ranging from 1 to 4 in. Pressure ratings up to 2,500 psi. are available.

#### Marshall and Stevens Indexes of Comparative Equipment Costs

(1926 = 100)

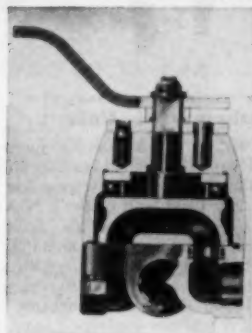
Compiled quarterly for March, June, September, and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 124-6. For a listing of annual averages since 1918 see *Chemical Engineering*, Feb. 1951, p. 158.

Industry	Dec. 1949	Sept. 1950	Dec. 1950
Average of all .....	159.4	171.5	177.1
<b>Process Industries</b>			
Cement mfg. ....	155.2	152.4	169.5
Chemical .....	163.2	171.4	177.5
Clay products .....	150.2	168.4	164.5
Glass mfg. ....	153.4	161.5	167.6
Paint mfg. ....	158.6	164.7	170.8
Paper mfg. ....	156.9	165.0	171.1
Petroleum ind. ....	159.7	167.8	172.9
Rubber ind. ....	162.1	170.2	176.3
Process ind. avg. ....	160.7	168.9	174.9
<b>Related Industries</b>			
Elec. power equip. ....	164.9	172.0	179.1
Mining, milling ....	164.0	172.1	178.2
Refrigerating .....	172.6	190.8	196.8
Steam power .....	158.0	160.1	166.7

#### REGARDLESS OF BACK PRESSURE:

#### Safety Relief Valve

(145E) The Balanscal safety relief valve is now being introduced by the Farris Engineering Corp. By properly proportioning the bellows and disk areas, this new valve eliminates the effects of back pressure caused by multiple valves discharging into a common downstream header, it is claimed. This feature permits reducing the size of the downstream piping because higher downstream pressures can be tolerated.



#### SHEARS THE FLUID:

#### Pressure Control Valve

(145F) A new design of Barksdale valve, developed specifically for extreme pressure control, works on what is called the Shear-Seal principle. Wiping action between the sealing members during operation of the valve is said actually to improve the sealing properties of the valve with use. Various models of this valve are made in sizes from  $\frac{1}{4}$  in. to  $1\frac{1}{2}$  in. and for pressures up to 6,000 psi. Service ratings include water, air, hydraulic oil, and gas.

#### ELECTRICAL & MECHANICAL

#### NO GRAB ON STARTING:

#### Friction Clutches

(145G) A new series of disk type friction clutches for stub or through shaft mounting and suitable for application to gasoline or electric motors, speed reducers, and auxiliary shafts, has been announced by the Edgemont Machine Co. These Type K clutches are said to engage and disengage positively with light pressure and to pick up the load without grabbing. Clutches lock positively in the engaged position and will neither engage nor disengage accidentally as speed is increased. A threaded steel adjuster provides fine adjustments.

(Continued)





FOR SIMPLIFIED MAINTENANCE:  
**Lubrication Unit**

(146A) A LubriKit for the re-loading of individual bearings and centralized lubricating systems has been designed and built by the J. N. Fauver Co. It consists of an electrically-operated barrel pump, mounted on a 400-lb. drum for the filling of grease reservoirs; a hand transfer pump on a 100-lb. drum for the delivery of oil; and a tool box containing hand tools, miscellaneous fittings, and hand guns for the servicing of individual bearings.



MAINTAINS CORRECT BELT TENSION:  
**Tilting Motor Base**

(146B) Lovejoy Flexible Coupling Co. is now producing a new lightweight, adjustable, tilting motor base for use with fractional horsepower motors. This new base is used in conjunction with variable speed pulley drives, but can also be used to facilitate belt changing on cone step pulleys. Speed changes can be made while the machine is in operation. Correct belt tension and alignment are constantly maintained.

MIGHTY MITE:  
**Storage Battery**

(146C) Yardney Electric Corp. has added a new model to its Silvercel line of storage batteries. The new model, No. 5 HR, is suited for use in

portable instrumentation units and other applications where space requirements are of primary consideration. The new battery, 3 in. high and weighing 4.3 oz., can be discharged at 5 amp. up to 60 min. and is capable of being discharged at rates up to 20 amp. It is said to be only one-fourth the weight and one-third the volume of a standard lead-acid battery of the same capacity.



DISCOURAGE SABOTAGE:  
**Outdoor Floodlights**

(146D) Weatherproof cluster lights for outdoor protective lighting are being made by Stone Mfg. Co. Cluster lights are a natural for plant protective and anti-sabotage lighting, inasmuch as burnout of a single floodlight in the cluster will not result in total darkness. The new unit is made of precision die-cast aluminum alloy.

WITH TWO-WAY BULB:  
**Emergency Light**

(146E) A new portable emergency light announced by Carpenter Mfg. Co. is powered by a heavy-duty, rechargeable, long-life battery. A special two-filament bulb furnishes work or rescue light for 80 continuous hr. per battery charge on one filament or a higher power floodlight for 20 consecutive hr. on the second filament. A substitute reflector provides a powerful mile-range searchlight when needed.

ASBESTOS PLUS TEFLON:  
**Mechanical Packing**

(146F) The A. W. Chesterton Co. is introducing Blu-Lon, a new chemically inert mechanical packing. Blu-Lon is made of pure African blue asbestos with each asbestos strand completely coated with Teflon by a special 700 deg. F. fusion process. This combination of materials provides a packing resistant to practically all acids and alkalies, it is claimed.



LARGER SIZES AVAILABLE:  
**Air Cylinders**

(146G) Miller Motor Co. is now offering large-diameter air cylinders of 15- and 30-ton lifting power. The 20-in. diameter cylinder produces over 30 tons of lift at rated operating pressure of 200 psi. This is the counter-balance type cylinder which is particularly adaptable for use on presses and other heavy production machinery. The standard line of air cylinders is now available in sizes up to 14 in. bore, the largest model having an output thrust of over 15 tons at 200 psi.

## PUMPS & COMPRESSORS



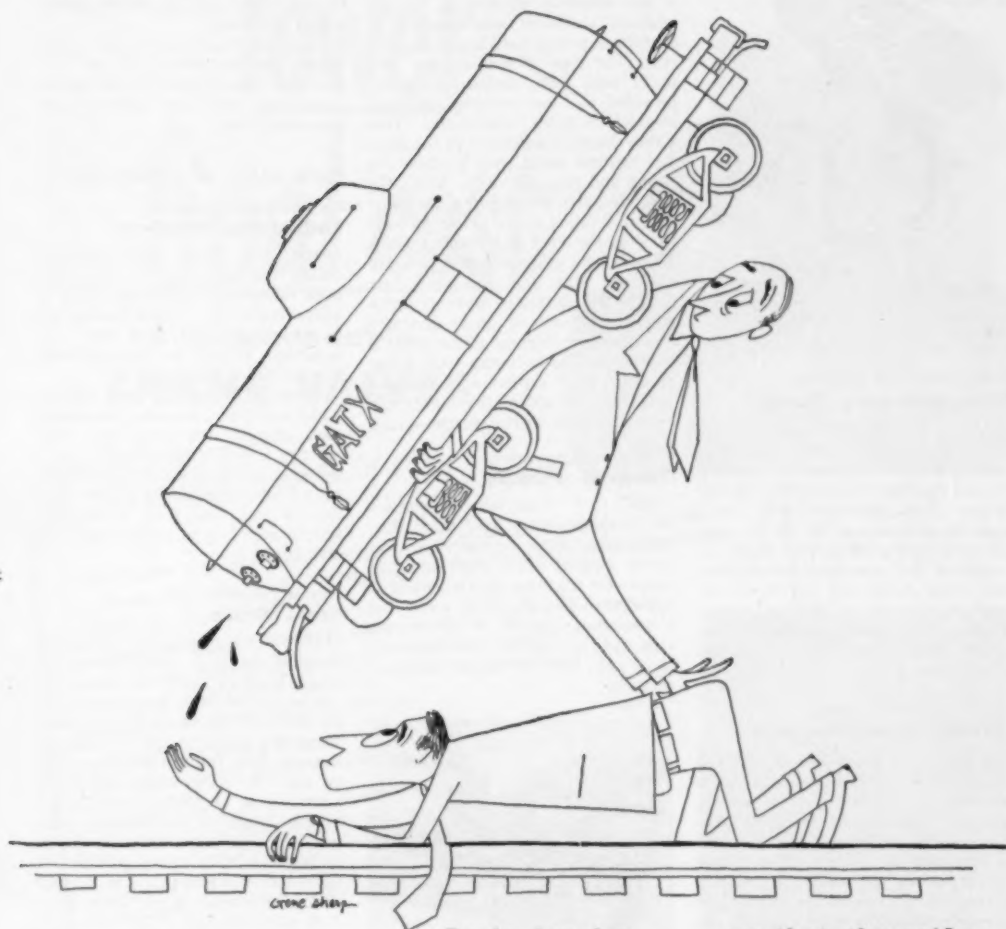
WITH DIESEL DRIVE:  
**Portable Rotary Compressor**

(146H) Ingersoll-Rand has come out with a new type of large portable air compressor, designated as the Gyro-Flow 600. It employs a two-stage, oil-cooled, rotating vane compressor, delivering 600 cfm. free air at 100 psi. This type of compressor eliminates pistons, connecting rods, valves, and need for a clutch. Under normal operating conditions, discharge temperature of the compressed air is claimed to be less than 200 deg. F., which is said to be at least 100 deg. F. lower than that of conventional portable compressors.

Driven by a General Motors Series 71 diesel engine which uses a fast-starting ether system for cold weather

(Continued)

## THE CARE AND NURSING OF TANK CARS



Drain 'em dry . . . so that the coils  
won't freeze and break.

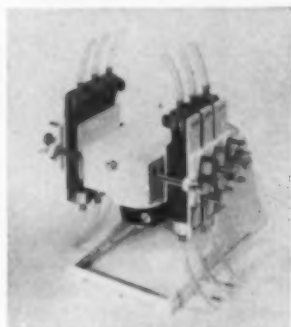
**Another way to get more from your GATX tank cars**



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operation, total weight of the machine is only 9,500 lb. Capacity control combines floating speed control of the engine and variable intake unloading of the compressor.



HALF A DOZEN IN ONE UNIT:

### Proportioning Pump

(148A) Primarily designed for laboratory and pilot plant work, this unit is a combination of six separate pumps operated by a single 1/20 hp. motor. Each separate pump has a capacity of from 1 to 500 cc. per min. of water or any other thin liquid. A regulated flow can be obtained from any single pump, and one to six separate liquids can be delivered simultaneously in desired proportions. The unit is manufactured by Brosites Machine Co.

### LESS LEAKAGE AND WEAR:

### Pump Improvements

(148B) A new type of shaft seal has been developed by Allis-Chalmers to eliminate stuffing box leakage on process pumps operating under positive suction pressures. The Equisal is basically a radially-vented sleeve which rotates with the shaft to create a pressure which equalizes the suction pressure. It has been designed for use on all Allis-Chalmers process pumps with suction heads up to 15 ft. at 1,750 rpm. or 6 ft. at 1,150 rpm., and is effective even when pumping viscous liquids or slurries.

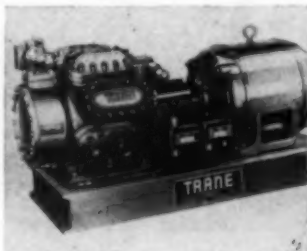
Inasmuch as the seal is effective only during operation of the pump, the stuffing box packing acts as the seal during idle periods. It is claimed that packing can be removed while the pump is operating on positive suction heads without leakage, even though there is a direct passage from pump suction to the atmosphere. The Equisal can be installed in the field on existing Types P and PD process pumps by purchasing the proper parts.

For pumps handling liquids containing stringy solids, such as paper stock, a new adjustable radial clearance wearing ring has been developed which reduces metal-to-metal wear caused by shaft deflection. Until recently, it was common practice to furnish relatively inefficient open impellers in centrifugal pumps handling such materials. The type of wearing ring normally used with enclosed impellers provided a close running clearance into which solids could enter. This action caused a deflection in the shaft and extreme metal wear between the casing and impeller rings. With the new adjustable wearing ring, any plugging or binding action places an axial force on the shaft and bearings which is insufficient to cause serious overload on these parts, and thus wears free. When the clearance becomes excessive through wear, it can be decreased by suitable mechanical adjustment. It is now possible to pump such things as paper stock slurries with enclosed impellers and obtain the higher efficiency inherent in this design.

### WITH ADJUSTABLE OUTPUT:

### Reagent Pumps

(148C) Two new Proportioners reagent pumps have made their appearance. Both pumps have clear plastic reagent heads and have provisions for adjusting delivery while in operation. The Pee-Wee pump has a maximum capacity of 100 cc. per min. and the Constaflow will deliver up to 10 gph., both at 100 psi. maximum pressure.



### SILENCE IS GOLDEN:

### Reciprocating Compressors

(148D) A new line of Trane reciprocating compressors has been especially engineered for smooth and quiet operation. These new compressors are claimed to be so free of vibration that they require no special foundations, floor construction, or soundproofing. Contributing to smooth operation are cylindrical body design, V and W arrangements of cylinders, balancing of

crankshafts, and reduction of moving weight by use of aluminum pistons and connecting rods. Noise is reduced through use of plastic-cushioned valves, aerodynamically designed suction and discharge gas passages, and location of all parts of the capacity control system within the body.

Designed for air conditioning applications, the new compressors are built in 10- to 50-ton capacities. Complete condensing units are made in corresponding sizes.

### PACKAGING & HANDLING

#### FOR HEAVY-DUTY HAULING:

### Industrial Trailers

(148E) Three new industrial trailers for heavy-duty hauling have been introduced by Phillips Mine & Mill Supply Co. These trailers are of all-welded, heavy gage steel construction. Wheels are equipped with Timken roller bearings.

Model TFP-100 is a 5-ton capacity trailer with 16-in. diameter pneumatic-tired wheels. Also rated at 5 tons capacity is the Model TF-100 which has solid rubber tires. Model TF-300 has a 15-ton capacity for heavier hauling. It has dual solid rubber-tired wheels and a removable stake near each corner.

#### CUSTOM TAILORED:

### Steel Drum

(148F) A new-type steel drum, designed to save warehouse space, speed handling, and cut transportation costs, has been demonstrated by the Shell Oil Co. at its Dayton plant. Then new drum is slightly taller and slimmer than the standard type now in use. Its tailor-made dimensions permit it to be loaded four abreast, double-decked in the average truck trailer, and five abreast, double-decked in box cars, thus saving considerable space over present type drums. Similar saving is also made in warehouse space.

A unique feature of the drum is its necked-in head, about 2 in. smaller in diameter than the rest of the drum. A logical extension of a principle already used in smaller containers, this feature makes it possible to stack the new drums directly one on top of another. It also permits handling by modified fork trucks without using pallets.

These drums are not yet in actual manufacture. The ones used in demonstration are part of 200 drums especially hand-made from Shell designs for testing purposes. The company expects to announce further developments within a few months.

(Continued)

# Longer service life at lower final cost

with dependable  
**CRANE VALVES**



## CASE HISTORY FROM CRANE FILES

**PROBLEM:** To find a more efficient and economical replacement for plug cocks having an average life of only 2 to 8 weeks in pipe lines handling liquid clay to filter presses.

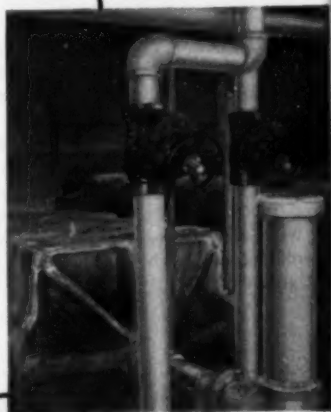
**WORKING CONDITIONS:** Working pressure 140 psi, with liquid clay flow creating highly erosive effect; also corrosive. Strong tendency to clogging. Operating cycles 5 to 6 per day; relatively quick opening and closing required.

**SOLUTION:** Crane No. 1610 Diaphragm Valves, iron body, packless design, with separate disc and diaphragm.

**RESULT:** After 11 months' uninterrupted service, Crane valves showed no significant wear or damage resulting from normal operating conditions. User assured of greatly reduced maintenance and replacement costs over plug cocks. No. 1610 Diaphragm valves approved for standardization on all filter press piping.

Another example of the greater value in Crane Quality, and the lower final cost of Crane Valves for every service. That's why . . .  
**More CRANE VALVES are used than any other make!**

No. 1610 Diaphragm Valve. Ask for literature on full line through your Crane Branch or Crane Wholesaler.



The installation—Onondaga Pottery Co., Syracuse

# CRANE

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill.  
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**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

CHEMICAL ENGINEERING—March 1951

2

# REASONS FOR CALLING IN MIXCO

## to supply fluid agitation on your next project

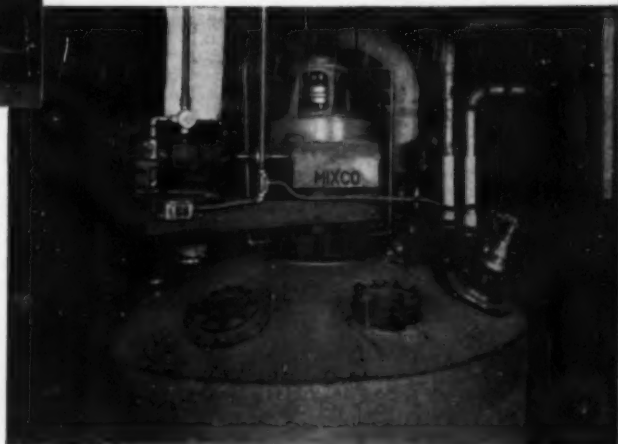


MIXCO research and development laboratory

**2. EQUIPMENT**... Lightnin Mixers are built for the critical years ahead. They are constructed for continuous heavy duty, with minimum maintenance. Interchangeable components make it easy to change the mixer from one type of installation to another—even from one speed to another—as your requirements change. Spare parts are standard and can be replaced quickly by any workman.

Write today for assistance on any fluid agitation problem, and for helpful literature on Lightnin Mixers.

**1. TECHNOLOGY**... Why guess, when you can be sure about fluid agitation? Mixco engineers choose correct agitation for you on the basis of viscosity, specific gravity, proximity, speed, power consumption and many other carefully considered factors. Exclusive Mixco data on impeller pumping capacities, critical shaft speeds, practical shaft lengths and other variables, saves you many an engineering headache, avoids costly trial-and-error, and gives you best possible agitation at minimum power cost. Results are guaranteed!



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☐ B-78 Top Entering Mixers ☐ B-36 Condensed Catalog showing complete line  
☐ B-89 Top Entering Mixers ☐ B-75 Portable Mixers (Electric and Air Driven)  
 (Turbine and Paddle Type)

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Turbine, propeller and paddle types. For open or closed tanks. 16 speeds available in new heavy duty drive. Sizes 1/4 to 500 HP.

A COMPLETE LINE . . . UNEXCELLED TECHNOLOGY

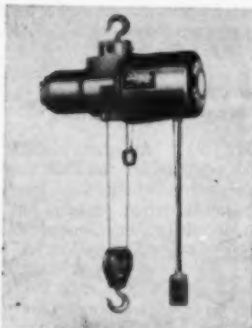




**40-TON GIANT:  
Industrial Lift Truck**

(151A) Completion of an 80,000-lb. capacity industrial lift truck has been announced by Yale & Towne Mfg. Co. Weighing 84,000 lb., this truck is powered by a 165-hp. diesel engine driving a 90-kw. electric generator. Despite the fact that the loaded weight of the truck will exceed 150,000 lb., only a finger-tip touch on the steering handle is necessary to actuate the hydraulic system that turns the wheels, according to the announcement.

Over-all height and over-all width are 178 and 124 in., respectively. Lifting height is 91 in. and turning radius 168 in.



**FOR HOOK SUSPENSION:  
Electric Hoist**

(151B) Wright Hoist Div. has announced their line of new Frame B Speedway electric hoists. Because they are made with a short, deep drum, these hoists are light and well-balanced and therefore ideal for hook suspension. They are available in capacities of from 250 to 1,000 lb. The hoists have shaved gears and a lower limit switch is standard equipment.



**BULK MATERIALS HANDLING**

(151C) An unloading tower and boom stacker with auxiliary conveying and distributing equipment handle sulphur and bauxite from steamship to distant located storage areas at an American Cyanamid plant at a rate of 600 gross tons per hr. The equipment was designed, manufactured, and installed by the Derrick & Hoist Co.

The stacker features a self-contained projecting lever arm, supporting a belt conveyor, which can be raised, lowered, and rotated in a complete circle. This stacker is said to be the first completely hydraulic-operated machine of this type.

**FOR EMERGENCY USE:**

**Lug Cover Container**

(151D) A new type container is now being made by Vulcan Tin Can Co. in 1 to 5 gal. capacity as an emergency substitute for the widely used standard ICC lug cover container. The new container has a tinplate body with hand-soldered locked seams and with covers and bottoms of either tinplate or clear lacquered black plate. Originally developed during the last war, it was widely used by industry when standard containers were impossible to obtain in any quantity. Although found to be quite satisfactory for heavier liquids and semi-solidified substances, it is not recommended for thin liquids.

**NO CHEATING HERE:**

**Package Counter**

(151E) A new package counter records every unit regardless of how tightly the packages move along the conveyor line, according to its manufacturer, the Alvey Conveyor Mfg. Co. This machine fits between sections of gravity, belt, or live roller conveyors. A short, powered belt carries each package forward to a barrier. Contact with the barrier causes an air cylinder to raise in front of the package. The belt then propels the package over the barrier and deposits it on the live

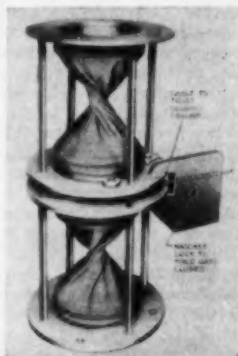
roller discharge unit, while the numbering machine registers the count. This positive stop eliminates accidental release and insures accuracy of count. Capacity is approximately 40 packages per min.



**DOUBLES AS A CONVEYOR:**

**Portable Hopper**

(151F) This unit, manufactured by the Klaas Machine & Mfg. Co., serves as a temporary storage bin, or becomes a material conveyor when needed. It is well suited for dry pre-mixed batches such as are required in rubber, glass, and chemical plants. The 1-cu. yd. hopper has a bottom dump to facilitate charging its contents from above into a furnace or reactor.



**WON'T CHOKE ON LUMPS:**

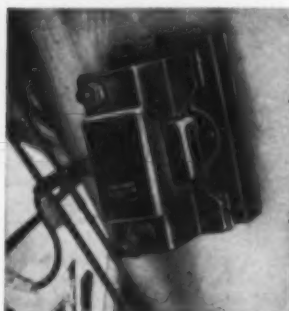
**Bin Valve**

(151G) The Twistite double-closure bin valve, recently placed on the market by Stephens-Adamson Mfg. Co., consists of two rubber sleeves joined by a rotating steel collar. In open position, solid material passes freely through the valve, with a resulting high discharge capacity. As the collar between the sleeves is rotated, (Continued)

## NEW EQUIPMENT, cont. . .

the sleeves twist until they completely seal the opening in two places. Any lumps which may be trapped in the valve will not prevent its closing. The sleeves simply wrap tightly around the lumps.

The valve is self-opening, the elasticity of the rubber sleeves causing them to resume their cylindrical shape immediately when tension on the cable-controlled collar is released. The valve can be hand controlled locally or remotely and can also be controlled automatically by use of a small actuating motor. Although only a 6-in. size is currently available as a standard item, other valve sizes can be supplied.



RUBBER BUMPERS REDUCE NOISE:

### Electric Vibrators

(152A) Syntro Co. announces the addition to its line of bin, hopper, and chute vibrators, of semi-noiseless models of the larger sizes. These new vibrators perform the same function as standard models, but with a sharp reduction in operating noise. This improved feature is obtained by eliminating the metallic striking parts and substituting rubber bumpers.

The new vibrators are available in four models, for use on small hoppers containing as little as 20 cu. ft. of material up to bunkers holding hundreds of tons. They are all furnished with the Syntro variable vibration controller by means of which the intensity of vibration can be regulated to suit the material being handled.

## INSTRUMENTS

WITH ADJUSTABLE RANGE:

### Electronic Recorder

(152B) A new Speedomax electronic recorder announced by Leeds & Northrup Co. features a range continuously adjustable over a 20 to 1 ratio, and zero suppression adjustable over more than twice the maximum range. Through use of a particular

suppressed zero range, an operator can ignore that portion of the range in which he is not interested, while he spreads the few millivolts he wants to watch across the entire width of the instrument chart. Adjustable range permits the user to select his own scale calibration at will.

Calibrated d.c. millivoltage range is adjustable from a minimum span of 1.1 mv. to a maximum of 22 mv. Un-calibrated coarse and fine rheostats provide maximum zero suppression of -50 or +50 mv., continuously adjustable between these limits.



### FOR PIPELINE INSTALLATION: Conductivity Cells

(152C) Armored conductivity cells for the measurement of strong sulphuric acid concentrations have been announced by Industrial Instruments, Inc. The new cells are supplied in pairs, with one cell as the reference and the other as the measuring cell. The pressure seal has been redesigned to eliminate dependence upon glass parts and to make the cells suitable for pipeline installations with line pressures up to 50 psi. They are made of heavy wall Pyrex glass with platinum electrodes. Metal parts are of either steel or Type 316 stainless steel.

FIVE STATIONS PER UNIT:

### Vacuum Gage

(152D) A new vacuum gage with a five-position switching attachment permits the connection of as many as five stations to each indicator. Manufactured by the Hastings Instrument Co., this gage is based on the noble metal thermopile principle. Measurement of pressure depends upon the lowering of the thermal conductivity of the gas as the pressure decreases.

In the new gage, matched tubes eliminate the need for adjustments when switching from one position to another. Calibrations of the tubes are not affected by exposure to atmospheric pressure or changes in ambient temperature, according to Hastings,

and there is no need to reset the current each time the pressure changes. The instrument will measure absolute pressures from 0 to 1,000 microns.



### FEATURES MOBILITY AND STORAGE SPACE: Infrared Spectrometer

(152E) The new mobile Model 12-C infrared spectrometer is now in production at the Perkin-Elmer Corp. Mounted on casters and small enough to pass through the usual doorway, this instrument can readily be moved as desired. The entire unit is compactly arranged so that all controls are readily accessible to the operator. Ample storage space in the cabinet is provided for cells, solvents, and other accessories.

Reduced recording time of a complete spectrum is obtained by automatic speed change programming on a new wave-length drive. A densitometer attachment, reading directly in absorbance or transmittance, makes for more accurate quantitative analyses, according to Perkin-Elmer.

USES A CRYSTAL AS AMPLIFIER:

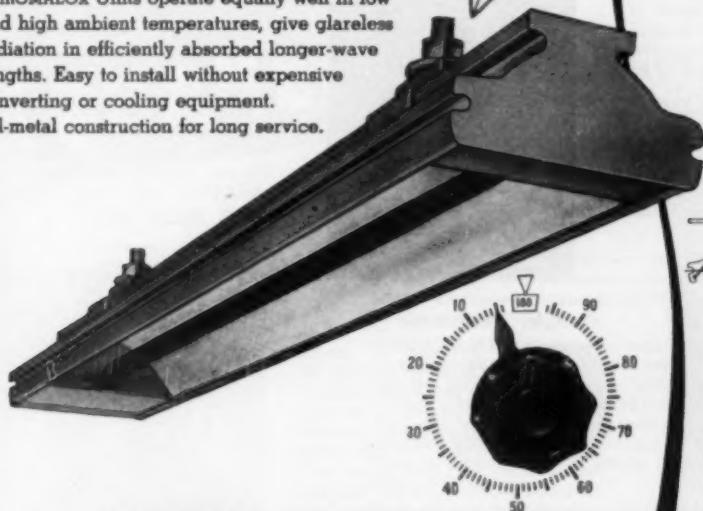
### X-Ray Apparatus

(152F) A discovery which may make possible for the first time the high-speed automatic X-ray inspection of many industrial products has been announced by the General Electric X-Ray Corp. The system is based upon the use of tiny crystals which, when excited with X-radiation, act as amplifier tubes, stepping up the energy a million fold. The crystals are said to be extremely sensitive, stable, and instantly responsive to variation in the intensity of X-rays. Because of the million to one gain permitted by the crystals, they do the work that hitherto required a much more complex system of vacuum tubes and amplifiers, while at the same time allowing the use of low intensity radiation. These crystals, composed of cadmium sulphide, can be grown from a fraction of a mm. to several mm. in size.

Laboratory machines have been

# Uniform, EXACT infrared heat at the turn of a dial

You can "dial" the exact uniform heat you need to fit the job in infrared drying, baking, preheating, curing, dehydrating and similar applications when you use CHROMALOX Electric Radiant Heaters. Compact CHROMALOX Units operate equally well in low and high ambient temperatures, give glareless radiation in efficiently absorbed longer-wave lengths. Easy to install without expensive converting or cooling equipment. All-metal construction for long service.



## CHROMALOX Radiant Heaters

**trouble-free** All-metal unit withstands shock, vibration, dust, blows and rough handling. Not affected by splashed liquids; nothing to shatter.

**flexible heat** Precise temperatures at the turn of a dial, easily regulated for changed working requirements. Ovens can be zoned for stepped-down heat.

**color-blind** Chromalox Radiant Heat ignores color variations; longer-wave length infrared is absorbed equally by all colors, textures, surfaces.

**uniform heating** Light, dark or multicolored work may be processed simultaneously. Proper heater positioning assures an even blanket of heat without hot-spots.

## CHROMALOX

*Electric heat for modern industry*

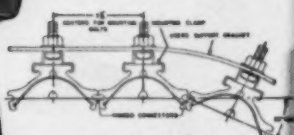
Only **Chromalox**  
Radiant Heaters offer  
these features

### ALL-METAL DESIGN



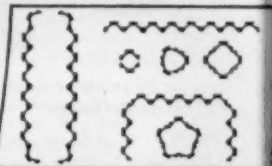
1. Inconel-sheathed Chromalox triangular heating element.
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### QUICK, EASY INSTALLATION



Clamps and interlocking joints simplify assembly of units into ovens, banks, tunnels, etc.

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Yes . . . send me the application file on  
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City \_\_\_\_\_ Zone \_\_\_\_\_  
State \_\_\_\_\_

built to inspect rubber heels, product level in various canned and packaged goods, and the continuity of powder trains used in blasting fuses. Other potential applications are the detection of voids, cracks, and thickness variations in a wide variety of homogeneous materials, checking for absence, misplacement, or misalignment of internal parts, and even eventually spotting foreign particles in foods, metals, and other products. Operation at a speed of as high as 600 units per min. in the case of canned foods and liquids is predicted. The device is equipped with a relay which can operate a meter, chart a graph, sound an alarm, or do any one of a number of things to call attention to faulty or sub-standard products.



ACCURATE ON CURVED SURFACES:  
**Thickness Gage**

(154A) A device for measuring the thickness of protective and decorative coatings, as well as unsupported films, is a new product of the Henry A. Gardner Laboratory. The principle upon which the new gage operates is the penetration of the coating or film with a needle until electrical contact is made with the metal base upon which the coating lies. The thickness of the coating is read from a dial which shows the distance the needle travels from its zero position until it makes contact with the base.

Although obviously this gage can be used only in cases where a non-conductive coating is supported by a metal base, several advantages are claimed. For example, readings can be made on curved surfaces as low as 5 in. in radius without introducing more than 0.10 mils error. Greater accuracy can be obtained and readings can be made on surfaces with even smaller radii of curvature, it is claimed, by setting the zero point on a bare surface of similar radius to that on which the measure-

ment is to be made. Results obtained with the gage are independent of the composition or thickness of the base, and there are no limitations as to edge effect. The gage can be used and is equally accurate in all positions. The dial is graduated in 0.05 mil steps and the nearest 0.01 mil can be estimated. The range of the instrument is normally zero to 20 mils, but can be readjusted to extend the range to approximately 50 mils.



EASILY READ DIAL:  
**Weight Indicator**

(154B) Available in models from 250-lb. to 20,000-lb. capacity, W. C. Dillon & Co.'s new weight indicator is claimed to be accurate to one scale division and sensitive to load variations of  $\frac{1}{4}$  of one division. Divisions range from  $\frac{1}{4}$  lb. for the 250 lb. model to 50 lb. for the 20,000-lb. model. The large 16-in. diameter dial with linear scale makes for easier reading. Protective dial cover is made of tempered Herculite glass, although plastic or safety glass can be substituted if desired.

The weight indicator is useful for weighing such materials as drums, crates, and long or bulky objects which cannot be easily moved to a central weighing point. The swivel hook is fitted with 360-deg. heavy-duty thrust bearing which is permanently sealed against dust or dirt. Eye-bolt opening is large enough to fit most standard hooks. Net weights, including eye-bolts and hooks, are from 42 to 68 lb.

OPERATES TOTALLY SUBMERGED:  
**Specific Gravity Indicator**

(154C) A new direct-indicating Densitrol has been added to Precision Thermometer & Instrument Co.'s line of liquid density measuring instruments. The instrument uses a totally submerged chain-weighted plummet as the measuring element. The plummet is self-centering, operates without friction, and will not stick to the sides

of the chamber. The 5-in. long scale is read across a single reference line on the plummet.

This instrument operates as a simple bypass in any liquid line. It is available in a controlling model in which the plummet position is determined by an electrical position measuring system. Ranges of 0.2 to 0.005 specific gravity can be furnished within the limits of 0.5 to 3.5 specific gravity. Calibration in terms of any of the common gravity scales can be supplied.

Where the liquid enters the Densitrol at a fixed temperature, the instrument is calibrated for this temperature or referred to a specified base temperature. Where the liquid temperature varies, automatic temperature compensation can be furnished.

Maximum pressure for models with any glass parts is 125 psi. All-metal models are offered in constructions to 500 psi. Materials of construction are available in a wide range of choices.

## SAFETY



MAKING SAFETY SAFE:  
**Portable Gas Detector**

(154D) The Lor-Ann Instrument Co. has announced a new explosion-proof portable instrument for detecting the presence of flammable or explosive gases. In making the detecting unit itself explosion-proof, the danger of a spark from the instrument igniting an explosive mixture has been eliminated. The instrument weighs only 6 lb. and measures  $5\frac{1}{2}$  in. diameter x 6 in. high. Only two controls are needed besides the on and off switch: a voltage check knob, and a zero setting knob.

FOR TIGHTER GOGGLES:  
**Padding Mask**

(154E) A new molded rubber detachable padding mask, made by Willson Products, Inc., assures an extra tight fit when wearing acid or

(Continued)

CONSERVATION  
MAINTENANCE  
PLAN  
BY

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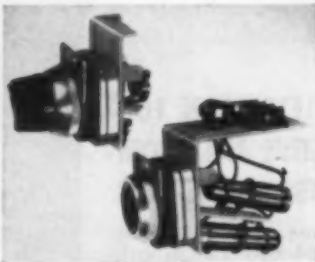


PHILADELPHIA 24 PENNA BRANCHES IN PRINCIPAL CITIES



#### NEW EQUIPMENT, cont. . .

welding goggles. The mask is attached to the goggles by means of a beaded molding which slips easily over the rims of the eye cups, providing a firm joint. The soft rubber assures a snug, comfortable fit for all shapes of faces. The mask provides the additional clearance needed when goggles are worn over prescription spectacles.



#### FOR HAZARDOUS LOCATIONS:

##### **Mercury Switch**

(156A) For safe use in hazardous locations, Panalarm Products, Inc. has developed a mercury switch with either pushbutton or selector knob. The unit consists of a hermetically-sealed mercury switch mounted on a lever-operated armature. There is no possibility of any spark, says Panalarm, because the actuating linkage is purely mechanical in nature. Designed for vertical panel mounting, the switch is single pole with either double or single throw action. Push-button models feature a spring action that returns the switch to original position when finger pressure is released. The selector switch type can, of course, be set in either "on" or "off" position.

#### THROUGH FLESH-COLORED GLASSES:

##### **Safety Spectacles**

(156B) For persons whose eyes are especially sensitive to light rays, safety spectacles are now being made from a special glass developed by Bausch & Lomb Optical Co. The new flesh-colored lenses tone down all visible light rays evenly. When hardened to approved specifications, they surpass safety requirements set by the U. S. Bureau of Standards.

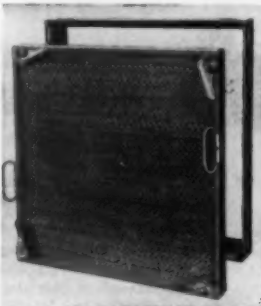
#### AUTOMATIC ADMINISTRATION:

##### **Emergency Oxygen Unit**

(156C) A new demand-type emergency oxygen unit has been developed by Mine Safety Appliances Co. Completely self-contained in a sturdy

carrying case, this unit is put in operation merely by opening the cylinder valve and placing the facepiece on the patient. Oxygen is administered automatically as the patient's breathing requires it. This instrument also can be used to supply oxygen in conjunction with artificial respiration. The complete unit consists of a half-mask facepiece, regulator assembly, 6 ft. length of breathing hose, and a 40 cu.ft. capacity oxygen cylinder.

#### FILTERS & SCREENS



#### FOR HIGH VELOCITIES:

##### **Air Filter**

(156D) A new high-velocity unit air filter developed by American Air Filter Co., is made of corrugated strips of fine mesh wire. The corrugations are so tapered that when two strips are placed together they form a series of pyramid-shaped pockets. The small closed ends of the pockets eliminate any open air passages through the unit.

Designated as Type HV, these filters are designed to operate at velocities up to 500 fpm. and are said to maintain a uniformly high cleaning efficiency over a wide range of air velocities. They can be serviced in the conventional way with washing and charging tanks or reconditioned by washing out accumulated dust with a hose and spraying with filter adhesive.

#### HANDLES HOT STUFF:

##### **Gyratory Sifter**

(156E) An all-metal gyratory sifter for separating dry granular products has been developed by Allis-Chalmers. Made of steel and magnesium, it can be cleaned by washing with hot or cold water, without danger of warping. Sieve screens are of silk or metal, as preferred. Wherever product purity is a prime requirement and long sieve life a desirable quality, the metal sieve is the logical choice.

In a typical application at a large Pennsylvania cork products plant, one of these machines is handling 200-250 lb. per hr. of ground cork. Abrasive materials, such as ceramic powders, sugar, or sand, can be sifted without appreciably wearing the box or sieve, it is claimed. The metal construction permits sifting of products at considerably higher temperatures than are permissible with wooden construction. The highest possible temperature at which the sifter can be operated satisfactorily has not as yet been determined, but operation at approximately 200 deg. F. continuously is said to be safe. The upper limit for a wooden sifter is generally set at 120 deg. F.



#### GET THE INSIDE STORY:

##### **Glass-Walled Filter**

(156F) A new glass-walled filter, employing porous stainless steel filter elements, permits full observation of what goes on inside. Produced by the Micro Metallic Corp., it should be especially useful in research and development work.

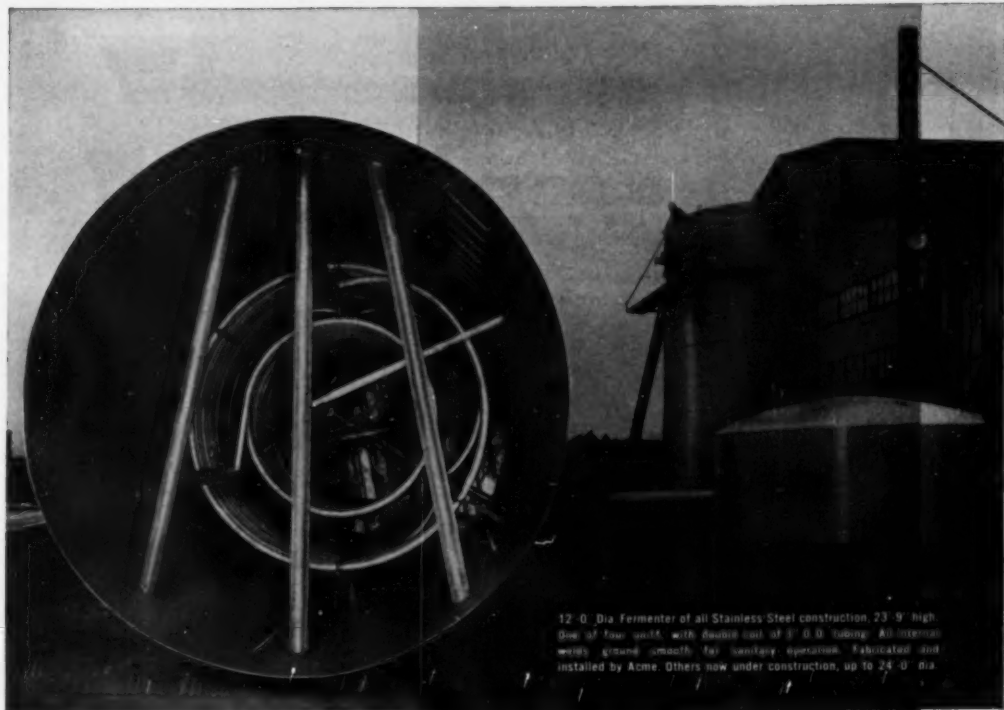
The porous elements contain 50 percent voids. Size of pore openings is closely controlled; pore sizes ranging from 5 to 165 microns can be obtained. Elements are made in Types 304 or 316 stainless steel or Hastelloy B, and Pyrex glass is used for the cylinder. The unit can be ordered complete with a centrifugal or positive displacement pump, mounted on an integral base.

#### LARGE AREA IN SMALL SPACE:

##### **Oil Filter**

(156G) A Staynew oil filter, recently announced by Dollinger Corp., is designed to prevent unnecessary wear on pumps and other equipment by eliminating the intake of abrasive particles from circulating oil. It is suited for application on machine

(Continued)



12' 0" Dia Fermenter of all Stainless Steel construction, 23' 9" high. One of four units, with double coat of 3" O.D. tubing. All internal wiring ground smooth for sanitary operation. Fabricated and installed by Acme. Others now under construction, up to 24' 0" dia.

# ANOTHER *Stainless Steel* INSTALLATION BY ACME

These Fermenters fabricated by Acme in Stainless Steel are just another link in the chain of Acme process plant equipment that serves the globe. Acme engineers and craftsmen have demonstrated time and again their ingenuity and versatility working with Stainless Steel, Stainless Steel Clad, Steel, Lead, Copper, Monel, Inconel, Nickel and virtually every other type of ferrous and non-ferrous metal and alloy. Acme installations have many times proven the soundness of their design in improved yields of high quality products. Regardless of what your process problem may be—a single piece of equipment or an entire plant—Acme experience and facilities are at your service.





#### PACKAGED FILTER UNITS

(158A) Kelly pressure filters are now manufactured in packaged assemblies, with all auxiliaries and accessories in a compact, ready-to-operate unit. Although designed primarily for handling molten sulphur, these units may find other applications where a jacketed pressure filter is required. An improvement over the standard Kelly filter is a simplified internal manifold type leaf outlet with single external connection. Made by Oliver United Filters, units are available in five sizes, ranging from 3 to over 200 sq. ft. of filtering area.

#### NEW EQUIPMENT, cont. . .

tools, hydraulic presses, and plastics molding machines.

Simplicity of construction is featured, there being only three major parts. The entire unit may be disassembled in 30 sec., it is said, for replacement or cleaning of the insert. The insert is built in the well-known Staynew radial fin construction, which provides a favorable area to volume ratio.

In most cases the filtering medium is 100-mesh stainless steel wire, but Monel, Inconel, brass, bronze, aluminum, galvanized steel, and a number of different fabric media are also available. Eight models are listed, with capacities ranging from 5 to 72 gpm. of 100 SSU oil and filtering areas from 1 to 14.3 sq. ft.

#### PROCESSING

WITH OPPOSING AGITATORS:

##### Jacketed Mixer

(158B) A 60-gal. stainless steel heavy-duty mixer has recently been designed by L. O. Koven & Bro., Inc., for jobs requiring quick and uniform mixing of pastes or heavy fluids under uniform temperature conditions. The horizontal mixing tank is rectangular in shape, with a half-round bottom, and is jacketed on the bottom for 36-in. of its 51-in. length for 125 psi.

steam. A full-length, stainless steel, ribbon type spiral agitator employs inner and outer ribbons having opposite thrusts. It is driven at approximately 87 rpm. by a 2 hp. gearhead motor.

The curved cover is hinged for quick and easy access. Discharge is made through a 1½-in. opening, using a 1½-hp. rotary pump. A thermometer is installed in the discharge line.

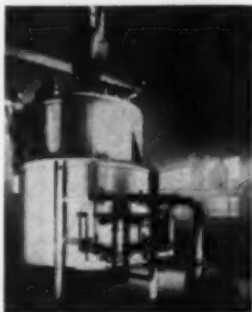
KNOCK DOWN AND DRAG OUT:

##### Entrainment Separators

(158C) A line of separators for removing entrainment from vapors passing through evaporators and other vessels is announced by the Centrifix Corp. These units are made in three models. Type AFE is a one-piece unit for installation in vessels with large enough nozzles for passing the unit through in one piece. Types AFD-1 and AFD-2 are made in 5 pieces and 11 pieces, respectively, to permit installation in vessels where access may be made only through small openings.

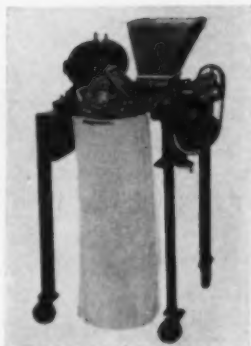
Vapors entering the separator are driven into a whirling mass which throws entrainment against the inner walls of the chamber, where it drains by gravity into annular races and is expelled through eject tubes. A vortex cone inside the purifier chamber reduces the possibility of re-entrainment. Extremely high separating efficiency and negligible pressure drop are claimed.

Units range in size from 12 in. to 36 in. and are available in steel, copper, nickel, and various corrosion-resistant alloys.



##### SYNTHETIC RESIN UNIT

(158D) A recent installation fabricated by the Brighton Copper Works is this 3,000-gal. stainless steel synthetic resin unit. The kettle is built for 15 in. vacuum or 40 psi. pressure. Special features include a radiant heat furnace and an internal cooling element of new design which replaces inefficient and hard-to-clean coils.



FOR DRY GRINDING:

##### Impact Pulverizer

(158E) A new model impact pulverizer, manufactured by the Pulva Corp., can be used for grinding a wide range of materials, such as pigments, dyestuffs, insecticides, pharmaceuticals, and plastics. Capacity of this mill, known as the Model A Pulva-Sizer, depends on the product being ground and fineness required. As an example, this machine, with a 5 hp. motor, will grind synthetic iron oxide at a rate of 700-800 lb. per hr. to a fineness of 99.7 percent through 325 mesh. On a tough and resistant material such as acrylic resin, capacity is only 20 lb. per hr. to a fineness of 50 percent through 40 mesh.

REQUIRES MINIMUM HEADROOM:

##### Change Tank Mixer

(158F) A new change tank mixer, designed for thinning down, shading, and tinting batches of 80 to 250 gal., is announced by Charles Ross & Son Co. An explosion-proof motor of either 3 or 5 hp. size is directly connected to the stirrer shaft, making a compact unit requiring a minimum of headroom. Two-speed motors and tank covers are optional features.

#### CONSTRUCTION MATERIALS

FOR SEVERE CORROSIVE CONDITIONS:

##### Hastelloy Tubing

(158G) Pipe and tubing of Hastelloy B and C can now be obtained from Carpenter Steel Co. Outstanding characteristic of Alloy B is its resistance to hydrochloric acid in all concentrations and at all temperatures, including boiling. It is also recommended for sulphuric acid at temperatures above 80 deg. C. It is not recommended for oxidizing atmospheres.

(Continued)

# Jones

## WORM-HELICAL SPEED REDUCERS



Jones Worm-Helical Speed Reducers are high efficiency units built in fifteen standard ratios from 40 to 1 to 250 to 1 for all common motor speeds. They are ideal for vertical shaft drives to agitators, mixers, bending rolls, etc.

The low speed shaft can be extended up or down, for coupling connection or gear drive.

Bulletin No. 75 covers complete details.

W. A. JONES FOUNDRY & MACHINE CO.  
4415 W. Roosevelt Rd., Chicago 24, Ill.

1890  
**60 YEARS**  
1950

Since 1890  
**Jones**

WORM-GEAR, BEVEL-GEAR, SPUR-GEAR, PLANETARY-GEAR, AND OTHER TYPES OF SPEED REDUCERS  
AND ALL TYPES OF INDUSTRIAL MACHINERY  
AND ALL TYPES OF INDUSTRIAL MACHINERY

## TIPS ON SOLVING DRYING PROBLEMS



### IS THERE SUCH A THING AS GUARANTEED PERFORMANCE FOR DRYING SYSTEMS?

There most certainly is such a thing as guaranteed performance. Every piece of Proctor drying equipment sold has a guaranteed performance rating written into the sales contract. The equipment must perform according to this guarantee before Proctor engineers consider their work completed.

Guaranteed performance is possible for Proctor equipment because nothing is left to chance at any stage in its development. A Proctor representative will talk with you the moment you realize you need drying equipment . . . will help you establish your requirements in specific terms . . . will assist you in considering preliminary and subsequent processing so that drying becomes an integrated part of the over-all process . . . will work closely with you as test work proceeds either in Proctor laboratories or your own plant . . . and will be in constant touch with the engineering, building, and installation of your equipment.

Guaranteed performance is no mere advertising phrase . . . but is exactly what you buy when you specify Proctor "job engineered" drying equipment.

The next time a drying problem presents itself—remember you can buy guaranteed performance by calling Proctor engineers into the picture early!

For the complete story of the Proctor approach to solving drying problems, write for Bulletin 361. For a lucid explanation of Proctor Drying Systems for the Process Industries, ask for Bulletin 342 as well.

#### A FEW TYPICAL MATERIALS BEING DRIED IN PROCTOR CONTINUOUS CONVEYOR SYSTEMS

Starch  
Titanium Dioxide  
Sulfur Drugs  
Calcium carbonate  
Magnesium carbonate  
Clay  
White Lead  
Finished Lithopone  
Soy Bean Protein  
Lead arsenate  
Nitro guanidine

### PROCTOR CONTINUOUS CONVEYOR SYSTEMS

PROCTOR & SCHWARTZ INC. • 711 TABOR ROAD • PHILADELPHIA 20 • PA •

#### NEW EQUIPMENT, CONT.

Because of its chromium content, Alloy C will withstand strong oxidizing conditions, such as those encountered with nitric acid, free chlorine, aqueous solutions of chlorine, and acid solutions of ferric and cupric salts. In addition, alloy C will resist phosphoric, acetic, formic, and sulphuric acids.

Round tubing of these alloys is being made in sizes from  $\frac{1}{8}$  in. through  $\frac{1}{2}$  in. Schedules 5 and 10 piping come in sizes  $\frac{1}{8}$  in. through 4 in. I.P.S., while Schedule 40 pipe is made in sizes  $\frac{1}{8}$  in. through 1 in. I.P.S.

#### THREE O'CLOCK OR ALL DAY:

##### New Welding Process

(160A) Automatic hidden arc welding has heretofore been limited in applications to jobs where the joint to be welded is in position for downhand welding. A new process developed by Lincoln Electric Co., referred to as "three o'clock" welding, removes this limitation and extends the advantages of automatic hidden arc welding to jobs where the joint is in position other than that for downhand welding.

This process is said to greatly reduce the cost of welding and expand the possibilities for the application of hidden arc techniques. It is suitable for applications such as fabricating of pipe



#### FLAME-GOUGING FOR BETTER WELDS

(160B) In fabricating this 7-ft. diameter autoclave, the head and shell were first joined by exterior welds. The bottom, or root, of the initial weld is being cut away by oxyacetylene flame-gouging from the inside. This interior head seam will be further cleaned with a chipping hammer before making the final interior weld. Flame-gouging differs from ordinary flame-cutting in that the cutting action does not progress all the way through the metal. Special flame-gouging nozzles are available from the Linde Air Products Co.



and field erection of large outdoor storage tanks.

#### NOT TOO HOT TO HANDLE:

#### Stainless Steel Beakers

(161A) Available in 1-, 2-, and 3-liter sizes, stainless steel beakers may find application in both laboratory and semi-works service. They may be obtained from Meyer Scientific Supply Co. Each beaker has a permanently attached Bakelite handle which remains comparatively cool during use and eliminates the necessity for using beaker tongs.

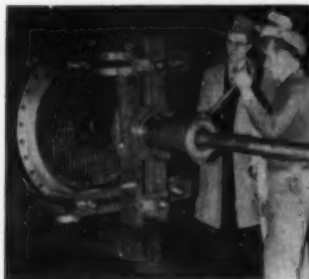
#### HEATING



#### WITH JET PROPULSION: Oil Burner

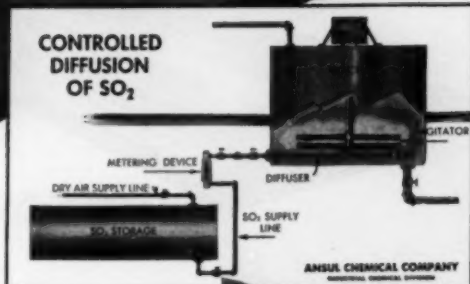
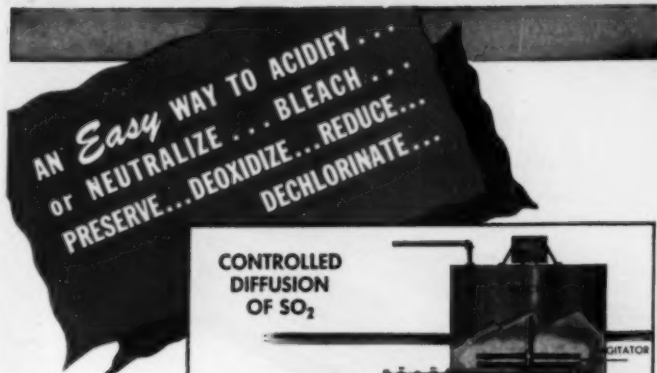
(161B) The Coppus Engineering Corp. has announced the marketing of an improved oil burner of the Fanmix type. This burner is so designed that the power requirement of the fan coincides with the power developed from the reaction force of the steam-atomized oil as it issues

(Continued)



#### TUBE BUNDLE REMOVER

(161C) Bundles in shell and tube heat exchangers may be removed by the new special jack pictured above. It has been designed by the M. W. Kellogg Co. to save construction costs, for heat exchangers supported above the ground, by eliminating conventional pulling beams and related structures. This bundle remover may also permit a more compact general plant layout and thus a smaller plot.



## IN One Continuous OPERATION ANSUL CONTROLLED DIFFUSION METHOD

ANSUL  $\text{SO}_2$  is a volatile, easy to control, multi-purpose acid. It permits the user to... 1) combine a number of individual process steps into one simple operation... 2) easily remove many product impurities sometimes difficult to eliminate... resulting in improved process efficiency and better quality control of the finished product.

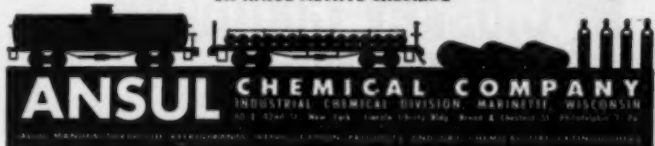


99.98%  
(by weight)  
**PURE**

• REG. U. S. PAT. OFF.

Write for Bulletin No. R-109 for more information and if possible, include a description of the application in your plant. Our Technical Staff will help you take full advantage of the benefits outlined above. In addition to our Bulletin describing the Ansul Constant  $\text{SO}_2$  Concentration System, we will send you an informative treatise describing the properties, characteristics and industrial uses of Liquid Sulfur Dioxide... An Ansul Technical Staff Publication.

For your METHYL CHLORIDE applications, Use ANSUL METHYL CHLORIDE





Fertilizer plant for  
F. S. Royster Guano Company

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**You will be pleased** like many of the largest companies around the world with your McCloskey Buildings. They have found that the complete construction services save them time and money. The modern flexible design also saves on initial investment and future maintenance.

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# McCloskey Company of Pittsburgh

### NEW EQUIPMENT, cont. . .

from rotating jets. If the amount of fuel is increased, the increased jet velocity causes a corresponding increase in fan speed, thus automatically maintaining the proper ratio of fuel to air. The constancy of this ratio improves the efficiency of fuel consumption, makes possible increased boiler ratings, and eliminates hot spots, it is claimed. Since Fanmix burners create their own forced draft, stack requirements are reduced and no forced draft equipment is required.



#### FOR DUAL FUEL:

#### **Packaged Boiler**

(162A) Erie City Iron Works is now offering the Keystone packaged steam generator in standard sizes from 75 to 800 hp. and for pressures from 160 psi. This unit is designed as a two-drum water-tube boiler, as illustrated, with conservative ratings based on 5 sq. ft. per developed hp. The large upper drum equipped with baffles and dry pipe is said to assure high quality steam. Combination burners are available for oil or gas, interchangeably.

Keystone steam generators require no special foundations or stacks. They may be installed by merely setting in place and hooking up service connections. Construction is in strict accordance with ASME and local codes.

#### UTILIZES EXHAUST STEAM:

#### **Feedwater Heater**

(162B) A feedwater heater designed specifically for small manufacturing plants with boiler capacities of 300 hp. or less is announced by the Swartwout Co. It operates on exhaust steam. Made of fabricated steel, it has specially designed stainless steel trays which disperse feedwater in the form of thin curtains over a large area in order to obtain even and rapid heat transfer. The unit is delivered complete with accessories, ready to install.

—End



*Shown are a few typical Swenson Spray Dryer installations used for chemical processing*

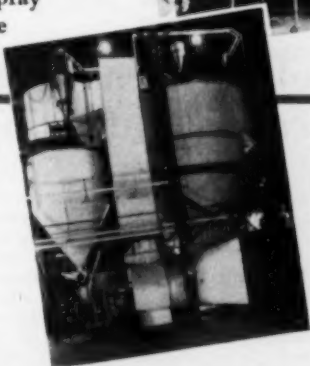
## SPRAY DRYERS FOR *NEW* CHEMICALS

**M**ore than half of the Swenson\* Spray Dryers used in chemical processing are operating on materials which were unknown just six years ago!

Swenson engineers, working with the only spray dryer laboratory of its kind in the world, are discovering how spray drying can be used for an ever-widening variety of materials. They are showing how spray drying can eliminate the time and cost involved in other processing steps.

If you have a process to which spray drying may be applicable, Swenson engineers will be glad to work with you.

\*Reg. U. S. Pat. Off.



**SEND FOR  
BULLETIN  
D-105**

### **SWENSON EVAPORATOR CO. DIVISION OF WHITING CORPORATION**

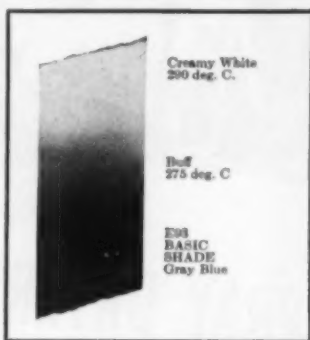
**15669 Lathrop Avenue Harvey, Illinois**

Eastern Sales Office and Export Department: 30 Church Street, New York 7, N. Y.  
In Canada: Whiting Corporation (Canada) Ltd., 47-49 LaPine Ave., Toronto 2

## New Products and Materials Edited by Richard V. Reeves

Ref. No.	Color Change	Deg. C.
G87	Pink— Lavender	80 295
E102	Pink— Blue Violet	115 310
GG55	Mauve Pink— Bright Blue	140 315
G97	Blue— Dark Green	160 310
60	Light Tan— Bronze Green Deep Purple Brown Pale Indian Red	190 240 310
E94	Bright Violet Blue— Bright Green Olive Green Dark Gray Light Gray Light Brown Buff	155 220 265 290 300 340
E106	Reddish Orange— Brick Red Brown Almost Black Medium Gray Dirty White	205 230 245 295 335
G75	Light Blue— Fawn	210
F41	Ochre Yellow— Brick Red	225
E104	Greenish White— Gray	235
E93	Gray Blue— Buff	275 290
E6	Scarlet— Brick Red Gray Brown Yellow Orange	285 370 440 625
F21	White— Brownish Yellow	320
E50	Mauve— Fawn Gray White	400 515 580
G6	Red— Brown Gray Yellow Orange Green	410 490 575 605

WHAT'S AVAILABLE: 15 basic shades.



HOW THEY WORK: 2 samples.

## New Color-Thermometers Are Temperature Indicating Paints

**Chameleon paint changes color with degrees centigrade, plays detective where thermometers cannot or would not go.**

(164A) Temperature-sensitive paints are now available in sufficient quantities for the first time since the war's end. With these paints, the entire surface of an engine or similar piece of equipment may be painted with a particular color. An irreversible change of color indicates when the temperature of the entire surface, or any part thereof, has attained or exceeded a predetermined value. In some cases, the result may look like a combination rainbow and the iso-

bars on a weather map. Such a pattern gives information on the temperature of the entire surface at a glance.

The paints, originally a product of I. G. Farbenindustrie, are distributed in the U. S. by the Tempil Corp., come in 15 basic shades.

There are more uses for the paints than you can shake an imagination at. For instance, Socony-Vacuum is using them in studies of cooling processes for air-cooled internal combustion engines. According to the company's technologists, it assists in determining proper locations for thermocouples to measure internal heat while an engine is in operation.

Without application of one of the paints, placing of thermocouples may distort air currents around the test

engine sufficiently to affect the accuracy of the measurements.

Socony-Vacuum experts said the paint is important in tests of the heat-transfer qualities of lubricants as well as of the efficiency of air-cooling arrangements. They added that it holds promise for development of lubricants with still greater efficiency for internal combustion engines of all types.

Other suggested uses for the paints: In heat treatment processes, a useful check is given by painting a spot of the appropriate paint on the article undergoing treatment. This provides, by a change of color, positive proof that the article had been through the oven. In the hot working (or local heat treatment) of light alloys, two spots of the most suitable paints, side by side, enable the working temperature to be controlled within very definite limits.

They can be used as indicators in processes which require molds or rollers to be preheated to the same temperature for each operation, and provide a simple and inexpensive way of safeguarding bearings, motors, circuit breakers, etc., from overheating. The paints facilitate the detection of faulty insulation of high-pressure steam pipes or burners which have "struck back."

For experimental work, they have good possibilities since intricate surfaces of moving parts on which elaborate measuring equipment would normally be required can be coated with one or more of these colors and isotherms plotted from the resulting color changes.

Main constituents of the paints, according to PB reports, are compounds of cadmium, cobalt, nickel, copper and manganese, a suitable pigment such as titanium dioxide, and a substance called Plastopal. Plastopal is a 50 percent solution of urea-formaldehyde resin in butyl alcohol. To obtain spraying or brushing consistency, products are reduced with ethyl alcohol—usually 100 parts color paste to 60 or 80 parts alcohol.

### COUPLING AGENT:

#### 1,3 Butylene Glycol

(164B) The start of commercial production of 1,3 butylene glycol has been announced by the Chemical Division of Celanese Corp. of America. The new product, a high boiling solvent and coupling agent, can be used as a humectant, solvent and lubricant in the textile, paper coating,

printing paste and dye and hydraulic fluid fields. Low toxicity and hygroscopicity suggest its application in the tobacco, cosmetic and pharmaceutical industries.

The butylene glycol is also a versatile intermediate for surface active agents, alkyl resins and rosin esters and allows the production of polyester plasticizers with high dielectric constants for use in electrical insulation compounding.

Celanese is also introducing, for the first time in continuing commercial quantities, 2,3 butylene glycol. The adjacent hydroxyl groups of this glycol make it interesting as a chemical intermediate for resins, elastomers, pharmaceuticals, and chemical specialties.

#### SOFTENS OXIDIZED RUBBER:

### Rubber Plasticizer

(165A) The performance life of all rubber parts and surfaces which have hardened, cracked and become inelastic with age can be greatly prolonged by a unique rubber plasticizer now being made available to industry by the Schwartz Chemical Co.

When applied by cloth or brush to an old rubber surface, it actually plasticizes the rubber and is said to impart the feel, grip, resilience and performance of new rubber.

Product is described as a non-flammable and non-volatile liquid.

Called Rub-R-Vive, the plasticizer is of great potential interest to office managers and plant superintendents who face the acute problem of conserving and lengthening the life of rubber products now in use in office and factory. This is particularly true, reports the manufacturer, because of the increasing importance of rubber to the defense effort and the rigid controls recently clamped down on this highly critical material.

Rubber feed rollers, platens, friction wheels, teletype rolls, gaskets, hose, and countless other rubber products need not be discarded when they deteriorate with age because the plasticizer will revitalize them so that they can continue to give efficient service, according to the manufacturer.

Available in pint, quart and gallon cans, the product is said to have excellent shelf life and its storage does not require a fire department permit.

#### REACTIVE:

### Diethyl Acetylsuccinate

(165B) This chemical is available for the first time in research quantities from Monsanto Chemical Co.'s Merrimac Division.

The product is a beta-keto ester, a highly reactive chemical useful in the synthesis of a wide range of organic compounds, including many organic acids and ketones.

Possible compounds of particular interest are the pyrazolones, which are useful as intermediates in azo dyes, and certain coumarins which are fluorescent in alkaline solution. The product also has uses as an intermediate in the synthesis of compounds with biocidal activity.

#### GOOD SUPPLY:

### Degreasing Solvent

(165C) Metal degreasing solvent, designed to remove the bulk of heavy accumulations on metals before vapor degreasing, is available from Colonial Alloys Co. Use of the product thereby permits maximum utilization of chlorinated solvents, now in short supply.

Tricyclodene, as the product is called, has a high flash point and is rated as a safety solvent. It can be reclaimed after it is spent by means of distillation and additions, or by filtration. It is not chlorinated and is not rated as toxic.

#### DISINFECTING:

### Floor Cleaner

(165D) A new disinfecting liquid floor cleaner, Germelim, is announced by the Davies-Young Soap Co.

With the new cleaner, floor surfaces of all types in industry, institutions and food processing and preparation

#### New This Month . . .

	Page & Item
Temperature-Indicating Paints . . . . .	164A
1-3 Butylene Glycol . . . . .	164B
Rubber Plasticizer . . . . .	165A
Diethyl Acetylsuccinate . . . . .	165B
Degreasing Solvent . . . . .	165C
Floor Cleaner . . . . .	165D
Compound F Scientists . . . . .	165E
Polyvinyl Resin . . . . .	166A
Corrosion Inhibitor . . . . .	168A
Phenolic Resin . . . . .	170A
Anti-Corrosion Formulation . . . . .	170B
Scale Preventer . . . . .	172A
Wax Amines . . . . .	172B
Psyche Drug . . . . .	172C
Metallic Ricinates . . . . .	172D
Resin Cements . . . . .	174A
Corrosion Resisting Paste . . . . .	174B
Dry Cleaning Soap . . . . .	174C

#### More Information . . .

To find out more about any of these new products, circle the item's number on Reader Service Postcard inside the back cover.

plants may be safely cleaned, sanitized, and deodorized in a single operation.

Active ingredients are potassium laurate, potassium myristate, and ortho-benzyl-para-chlorophenol. It has a phenol coefficient of 3.5—equal to 3½ times the germ killing power of carbolic acid—yet it is completely safe to use.

Most dangerous floor bacteria are destroyed on contact with the material. It is equally effective on all floor surfaces and may be used with either manual or mechanical methods of cleaning. (Continued)



#### COMPOUND F SCIENTISTS

(165E) First chemical synthesis of 17-hydroxycorticosterone (Kendall's Compound F), only known substance believed to possess anti-rheumatic activity comparable to cortisone and ACTH, achieved by these Merck chemists. From left: Drs. R. P. Graber; R. E. Jones; Max Tishler, director of developmental research; and N. L. Wendler.





## Where is the safest place to keep your documents?

Are your contracts, blueprints, accounts receivable—the records that keep your business going—really safe?

If you've ever seen business papers charred by fire . . . or made illegible by water from fire fighting, you'll want to make sure it can't happen to your records.

Wherever you store these papers, you can rely on a *Kidde* Fire Extinguishing System to protect them. A Kidde System uses carbon dioxide—a gas that won't mark, stain or discolor papers—and it puts out fire *fast*.

You can put a Kidde system on guard over one or many record vaults . . . ready at the first sign of flame to release a fire-smothering cloud of  $\text{CO}_2$  . . . and do it *automatically*.

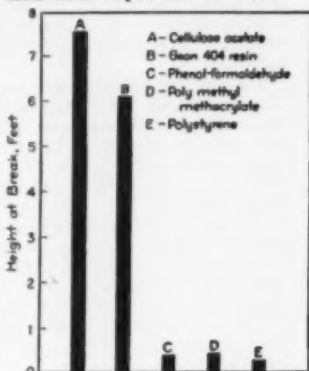
Why not go *all the way* in protecting your papers. Call a Kidde expert for full information.

# Kidde

Walter Kidde & Company, Inc., 328 Main Street, Belleville 9, N. J.  
In Canada: Walter Kidde & Company of Canada, Ltd., Montreal, P.Q.

## NEW PRODUCTS, cont. . .

### ADVANTAGES: Impact Resistance . . .



### ... NO PLASTICIZER:

#### Polyvinyl Resin

(166A) A new, high molecular weight polyvinyl resin that can be processed without plasticizer has been said to create a range of applications in the fields of structural plastics and wire and cable insulation for polyvinyl materials, according to B. F. Goodrich Chemical Co.

Called Geon 404, the new resin has the outstanding electrical, physical, and chemical properties of pure, unmodified polyvinyl chloride, and can be processed (extrusion, calendaring or molding) successfully into "rigids" on conventional plastics equipment.

Under present emergency conditions, according to the company, the new resin will be available in limited quantities and only for the development of military and other essential application.

Although unplasticized polyvinyl chloride has superior characteristics that should render it an outstandingly rigid plastic, it has never enjoyed more than a small percentage of the total market. Principal reason has been the relatively poor processability of the vinyls currently available as compared with the polystyrenes, acrylics, celluloses, etc.

Plasticizer addition in vinyl compounding has not solved this problem. Incorporation of plasticizer in high quality rigid vinyl compositions has only resulted in impairment of properties. To date the high quality vinyl resins produced in this country—in Germany straight polyvinyl chloride sheets and tubes have been used since the war—are generally considered too dry and tough, even at high temperatures, to be usable without plasticizer.

Application of the resin in the electrical field will mean new and broader

(Continued)



How Celite Mineral Fillers give a product delicate abrasiveness...



## Putting a "Soft" shine in polishes

TO PRODUCE A POLISH that is scratch-free—yet contains exceptional cleaning powers—most leading manufacturers of fine polishes use one of the Celite Mineral Fillers as a standard ingredient.

This use of Celite Fillers is based on

their delicate non-scratching abrasive action—a property that derives from their porous, thin-walled cellular structure. It is one of many unusual physical characteristics that adapt these diatomaceous silica powders to numerous industrial uses.

### THESE CELITE PROPERTIES BENEFIT MANY TYPES OF PRODUCTS

Because of their inertness and great bulk per unit of weight, Celite Mineral Fillers make ideal bulking agents for powders and pastes. Their tiny multi-shaped particles interlace to stiffen and strengthen admixtures. The microscopically small facets of these particles diffuse light so effectively that they can be utilized to impart any desired degree of flatness to a surface film. Their light, porous nature improves suspension, helps prevent segregation. And

their high absorption properties and unique diatom structure make them unusually effective as a means of overcoming caking in deliquescent materials.

If you are looking for the "extra something" to lift your product above competition—at a negligible cost—why not discuss your problem with a Johns-Manville Celite Engineer? For further information and samples, write Johns-Manville, Box 290, New York 16, N. Y.

### CHECK LIST OF PRODUCT BENEFITS OBTAINABLE AT LITTLE COST WITH CELITE MINERAL FILLERS

- Added Bulk
- Better Suspension
- Faster Cleaning Action
- Greater Absorption
- Improved Color
- Better Dielectric Properties
- More Durable Finish
- Increased Viscosity
- Elimination of Caking
- Higher Melting Point
- Better Dry Mixing
- Improved Dispersion



**Johns-Manville CELITE**

**MINERAL FILLERS**



**You'll find  
DEMING SUMP PUMPS  
in the most unexpected  
places!**

● Ordinarily, you'll find Deming Sump Pumps on such jobs as sump drainage, or pumping heavy viscous or hot liquids in chemical or metallurgical work or performing many other "normal" jobs of liquid handling. But you'll also find these versatile pumps as component units of other equipment, such as illustrated above. Here you see a standard Fig. 4610 Deming Sump Pump as a component part of the Kelly Sulphur Filter, engineered and manufactured as a standard "PACKAGED" unit by Oliver United Filters Inc.

Function of the Deming Sump Pump is pumping a mixture of filteraid and pre-clarified molten sulphur through the Kelly type pressure filter.

This operation precoats the filter leaves with a layer of clean filteraid . . . thereby aiding the clarification of the dirty sulphur during the processing and producing an easily discharged cake.

Service of the Deming Sump Pump involves a capacity up to 60 gallons per minute at discharge heads not exceeding 20 PSI at temperature from 280 to 290°F.

Somewhere in the complete line of standard Deming Sump Pumps, you, too, may discover the most efficient and economical solution to your problem of liquid handling.

**Suggestion:**

Send for illustrated SUMP PUMP BULLETIN 4600A.

**SEND FOR  
BULLETIN  
No. 4607**



**THE DEMING COMPANY**  
525 Broadway • Salem, Ohio

**DEMING PUMPS**



**NEW PRODUCTS, cont. . .**

uses for the vinyls than heretofore. Rigid vinyl insulation based on 404 has electrical properties definitely superior to and attainable with plasticized polyvinyl chloride. The unique combinations of its superior physical properties (deformation, abrasion, and cutting resistance) and electricals, indicate such possible uses as (1) weatherproof line wire, (2) primary insulation on military field wire and aircraft wiring, thus eliminating need for a jacket, (3) radio hook-up wire, (4) television lead-in wire, (5) Navy cable and coaxial cable jackets and others.

Geon 404's outstanding chemical resistance coupled with ease of fabrication, machinability — and even weldability—introduces a Geon resin for the first time into the field of structural plastics.

Sheets, rods, and tubing of various diameters can be fabricated ranging from brilliant opaque to translucent and in a wide color variety. Rigid sheets can be welded by the hot gas technique, then fabricated into fume hoods and ducts for use where most metals are unsatisfactory. Tanks for corrosives can be made from it, in supported form, or as lining for metal tanks. In deep drawn and various welded forms it can be converted into pitchers, trays, funnels, buckets, barrels, etc., for use wherever an inert material is required. Other industrial equipment requiring this combination of machinable and chemical resistant plastic includes bearings, valves, gears, scoops, safety jugs and bottles.

Flexural strength, resistance to cold flow and warpage, wear resistance, and light weight of the new rigid make it excellent for varied containers—instrument covers, etc. The transparency and color range of many rigid products made from 404 indicate uses in structural display. Because it can be drawn and molded to reveal the finest detail, topographical maps for military and survey uses can be formed.

**ECONOMIC:**

**Corrosion Inhibitor**

(168A) A corrosion inhibitor for steam and condensate lines, has been released by the Allis-Chalmers Co. The liquid material, designated as No. 160 Series Corrosion Inhibitor, is effective against carbon dioxide and oxygen in the system. The inhibitor acts in two ways: by neutralization and by surface adsorption. The amines of which it is composed, volatilize and pass from the boiler with the steam. Upon condensing, they neutralize the condensate, increase its pH,

(Continued)

# Safety for Surfaces!



## WITH PENTEK®

The wearing qualities of any protective coating are dependent on the ingredients used in formulation. Heyden PENTEK (Pentaerythritol, Technical)—properly employed in the manufacture of paints, enamels, varnishes, lacquers and other finishes—adds that extra "safety to the surface" through increased durability, hardness and lustrous beauty.

Protective coatings formulated with PENTEK display remarkably high resistance to soap, water and alkali. Coatings manufacturers are also interested in PENTEK as a raw material for waxes, plasticizers and emulsifying agents. Samples and technical bulletin sent promptly upon request.

*PENTEK is shipped in 80 lb. multiwall bags.*

**DIPENTEK®**

**TRIPENTEK®**

**SERVING INDUSTRY THROUGH FINER CHEMICALS**

## Chemicals



Benzaldehyde • Benzoates • Benzyl Chloride • Bromides  
Chlorinated Aromatics • Creosotes • Formaldehyde • Formic Acid  
Glycerophosphates • Guaiacols • Hexamethylenetetramine  
Medicinal Colloids • Methylene Disalicylic Acid • Paraformaldehyde  
Parahydroxybenzoates • Penicillin • Pentaerythritols • Propyl Gallate  
Resorcinol • Salicylates • Salicylic Acid • Streptomycin

# R·P·C VALVES



NO. 8058  
Forged  
Steel  
Gate Valve

**Here is a Premium Valve  
that is NOT premium priced**

**CHECK THESE DESIRABLE FEATURES:**

- Bolted bonnet construction
- Heat-treated and hard chrome plated stainless steel wedge
- Stainless steel gland eye-bolts and nuts
- Two-piece gland and follower
- Tongue and groove bonnet joint

*It's well designed. It's low priced in its field.  
See your R-P & C distributor or write nearest R-P & C district office.*

R-P & C VALVE DIVISION  
AMERICAN CHAIN & CABLE

"Intentionally Better"  
READING-  
PRATT & CADY  
VALVES

## NEW PRODUCTS, cont. . .

and thus minimize its corrosiveness on ferrous metals. Upon their return to the boiler with the condensate, they again volatilize with the steam and are available for recycling through the system. The second action is the result of adsorption on metal surfaces. In effect, it produces a protective film to polarize the cathodically active points which may exist in the system.

Since the inhibitor is a liquid and relatively inert chemically, application methods are quite simple. No special feeding equipment is required.

Use of the inhibitor is recommended where economic considerations do not justify expenditures for deionizers or sodium-hydrogen zeolite softeners.

## FOR PLYWOOD GLUING:

### Phenolic Resin

(170A) A new phenolic resin for hot press plywood pluing that produces glue lines passing Army-Navy aeronautical specifications has been announced by the Plaskon Division, Libbey-Owens-Ford Glass Co.

The new glue has been developed to allow users of Plaskon glue in the woodworking field to undertake government mobilization work with a glue meeting the military requirements. Designated Plaskon 815-12, the resin is sold as a finely powdered material, red to brownish red in color.

The phenolic resin may be extended up to 20 percent with walnut shell flour where cheaper mixes are desired.

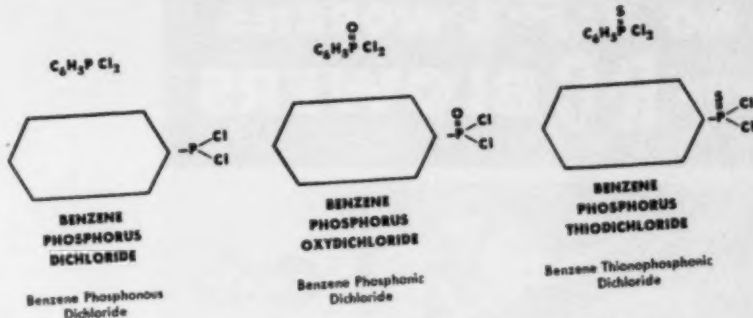
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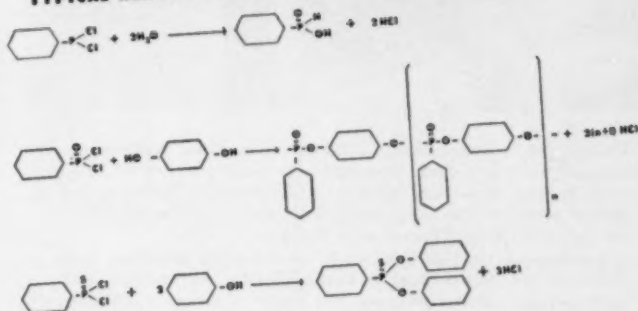
## ANTI-CORROSION FORMULATION

170B Right half of metal sheet coated with General Electric's R-108 which may replace scarce tin in food canning. Materials with R-108 in formula resist corrosion.





### TYPICAL REACTIONS OF BENZENE PHOSPHORUS CHLORIDES



## How You Benefit from Victor Research

It pays to keep an eye on Victor research. Alert watchers, for example, have already found excellent uses for these phosphorus chlorides that were commercially developed in Victor's research laboratories.

What properties do you seek in a phosphate, formate or oxalate? What's your specific problem that specially developed derivatives of these important chemicals may solve? Ask Victor. We may already have the answer... or may be able to get it for you.

This is a part of Victor's accent on service to industry. There's no obligation, of course.

Additional information on Victor organic phosphorus chlorides and their derivatives, as well as experimental samples are available. Check and clip the coupon to your letterhead or write if you prefer.



### VICTOR CHEMICAL WORKS

141 W. Jackson Blvd., Chicago 4, Ill.

A. R. MAAS CHEMICAL CO., Division  
4570 Ardine Street, South Gate, California

ATTACH THIS COUPON  
TO YOUR LETTERHEAD

Please Check  
INFORMATION SAMPLES

- ☐ ☐ Benzene Phosphorus Dichloride  
☐ ☐ Benzene Phosphorus Oxydichloride  
☐ ☐ Benzene Phosphorus Thiodichloride

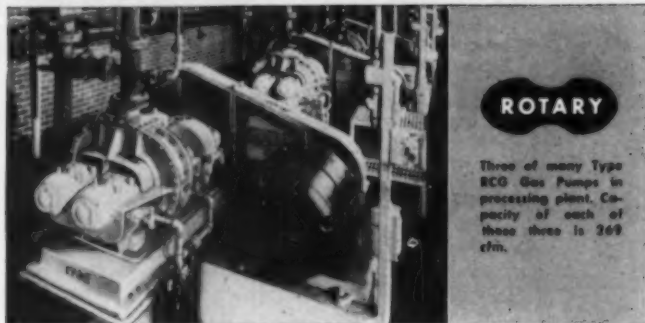
Name \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# NO V.P.L. WORRIES WITH R.C. BLOWERS



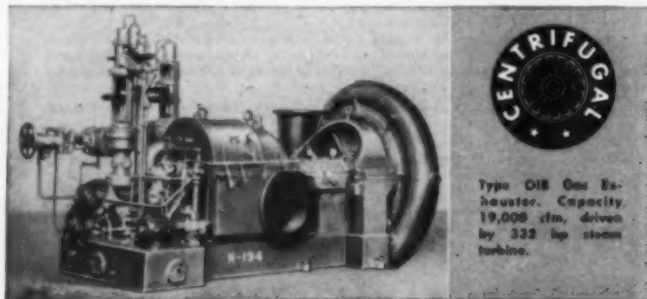
Three of many Type RCO Gas Pumps in processing plant. Capacity of each of these three is 369 cfm.

Today's production urgencies call for "no-vacation" performance from blowers and other equipment to move gas and air. You must be sure of positive Volume, at the required Pressure, and at Low power cost to keep down rising expenses. The answer is Roots-Connorsville Blowers with V-P-L.

You can obtain this freedom from worry by installing your choice of R-C Centrifugal or Rotary Positive equipment. This exclusive *dual-ability* gives you the choice of either type to best meet your requirements. Wide latitude in sizes, from 5 cfm to 100,000 cfm, permits selection of units with capacities close to your specific needs. Often, this flexibility saves time, cost, space, weight and power charges.

R-C engineers will gladly counsel with you on any problem of moving or measuring gas or air to keep production going.

ROOTS-CONNERSVILLE BLOWER CORPORATION  
510 Illinois Avenue, Connorsville, Indiana.



Type O18 Gas Exhauster. Capacity, 19,000 cfm, driven by 333 hp steam turbine.

## ROOTS-CONNERSVILLE



ONE OF THE DRESSER INDUSTRIES

### NEW PRODUCTS, cont. . .

Caustic soda added to the mix of resin, water and flour allows shorter assembly times than normal, if so desired.

Moisture content of woods glued with 815-12 is critical and moisture contents of 7-8 percent are recommended for optimum results. Standard pressures used with other synthetic resin glues are applicable to use of the product. Four hours of closed face assembly time will produce durable glue lines with little or no bleed-through.

Platen temperatures of about 290 deg. F. and sufficient press time are necessary to effect full cure of the resin. An example:  $\frac{3}{8}$  in.-3 ply birch panel, pressed at 280-290 deg. requires 5 min. for full cure.

### ECONOMICAL:

#### Scale Preventer

(172A) New wood utilization is the use of waste cedar shavings in a compound that is said to prevent formation of rust and scale in boilers and in steam and water pipes. Borgana is the name of the product which utilizes no critical chemicals in its manufacture, Portland Shingle Co., the producer.

Although the product has been on the market for two years and has found wide acceptance on the West Coast according to Portland spokesmen, eastern markets have not been exploited until now.

#### Wax Amines

(172B) Petrolite Wax Amines A, B and C have been made available in experimental quantities by the Petrolite Corp. It is believed that these new products might be useful in the manufacture of corrosion inhibitors, waterproofing agents, fungus and mildew-proofing agents, anti-static waxes.


#### Psyche Drug

(172C) Amphetamine phosphate, a drug valuable for treatment of mild depression of psychogenic origin is being marketed by Sharp and Dohme. The new product, called Ampave, also contains caffeine, comes in tablet form.

#### Metallic Ricinoleates

(172D) A line of metallic ricinoleates has been put on a pilot-plant availability scale by the Baker Castor Oil Co., with larger amounts promised, if needed. Barium, cadmium, cal-

(Continued)



## Latest Fractionation Facilities...

### produce special solvents tailored to your needs

sulphur removal from Roosevelt's aliphatic naphthas means non-corrosive, chemically stable solvents, free of offensive odors . . . Flexible, Kaskade-type fractionating towers, plus constant quality-control analysis means every shipment will meet your specifications. Send us your solvent specifications today!

WRITE FOR COMPLETE INFORMATION

You'll find the special solvents produced by Roosevelt will help you produce products to meet your high-quality standards. *Complete* catalytic



**ROOSEVELT**

*oil and refining corp.*



## SEND FOR PSC BUBBLE CAP BULLETIN 21

*Largest Compilation of Engineering Data.*

*Lists 200 Styles Furnished Without Die Cost.*

This standard reference contains complete specification information for over 200 standard styles of bubble caps and risers. Also drawings for use in determining methods of tray assembly. All styles list-

ed in Bulletin 21 are furnished promptly, without die cost, and in any alloy to meet your coking or corrosion problems. Special caps gladly designed; write as to your needs.

THE PRESSED STEEL CO., 707 N. Penna. Ave., Wilkes-Barre, Pa.



Custom Fabricators for the Process Industries Since 1928. Send Your Blue Prints

### Nicholson Steam Traps

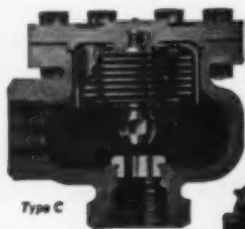
## CUT HEAT-UP TIME 48%

A large processor recently reduced the heating cycles of cookers from 105 min. to 50-60 min., by substituting Nicholson thermostatic steam traps for a mechanical type. This effected a gratifying production increase of 37%. Reasons for Nicholson's faster heat transfer: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic traps send for our catalog.

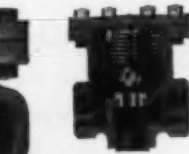


Type AU

Type ANY



Type C



Type B



Type A

**BULL. 450**  
or See  
Sweet's

5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes, 1/4" to 2"; press. to 225 lbs.

**W. H. NICHOLSON & CO., 206 Oregon St., Wilkes-Barre, Pa.**

*Sales and Engineering Offices in 53 Principal Cities*

### NEW PRODUCTS, cont. . .

cium, magnesium and zinc ricinoleates are available.

Current studies of the ricinoleates indicate that they parallel or surpass the performance of metallic stearates in their many applications.

### Resin Cements (174A)

Good electrical properties.

Can be cast in almost any form.

A new resin cement can be cast in almost any form and exhibits practically no voltage drop when used as a conductor. Made by the Atlas Mineral Products Co., the cement is called Conductoplast. The material can be readily plated, has a tensile strength of 1,500 psi, a compression strength of 15,000 psi and excellent adhesion to ceramic materials.

A non-conductor called Resistoplast has also been developed. It has much the same properties, except that it does not conduct current.

Supply—Both materials are available in pilot plant quantities.

### Corrosion-Resisting Paste (174B)

For metals, wood and concrete.

Fire resistant, water repellent, non-poisonous.

A non-drying paste, designed to resist corrosion of metals and rotting of woods and concrete mixes, is being marketed by American Sand-Banum Co. Name of the product is Tinalium Pro-Tex-It.

The black paste contains no lead oils, praphite, creosote or tar. It can be applied by brush while the paste is cold, regardless of atmospheric conditions of any climate.

### Dry Cleaning Soap (174C)

Produces highly stable emulsions.

Disperses moisture finely and uniformly throughout the washer.

Thrifttext, a new dry cleaning soap which is both a detergent and an emulsifier, was introduced recently by the Pennsylvania Salt Manufacturing Co.

The manufacturer states that the product has been designed for economy.

### Correction

Chloroparaffin 40, a product of the Bakelite Div. Union Carbide and Carbon Corp., was incorrectly labelled "Cycloparraffin 40" on p. 164 of our January 1951 issue.

—End

# THESE TROUBLEMAKERS



IN PLANTS  
EQUIPPED  
with

**CASH STANDARD**  
*Streamlined* TYPE 1000  
PRESSURE  
**REDUCING VALVES**

THESE Users TELL WHY . . .

## A Conditioning Corp. writes—

"Had a very critical job where it was important to HOLD CONSTANT PRESSURE TO VERY CLOSE TOLERANCES because we were using steam to reheat air to a set degree with allowed variation of less than one degree. Changed pressure reducing valves twice, then tried a CASH STANDARD Type '1000' and were able to accomplish the job."

## A Maintenance Engineer says—

"I would be more than willing to recommend the performance of the CASH STANDARD Type '1000' Pressure Reducing Valve because we used the valve here UNDER ADVERSE CONDITIONS and found it PERFECT IN EVERY WAY—TROUBLE FREE and PRACTICALLY NO MAINTENANCE COSTS."

## A Supt. of a Public Utility says—

"We operate a CASH STANDARD '1000' valve reducing steam pressure from 400 to 175 lbs. on our low pressure steam turbines' condenser air ejectors which is an important function and it has done the job WITHOUT FAILURE TO DATE."

## A Tobacco Co. writes—

"We use only one '1000' valve in this department. It is used on the steam line to our Castle Autoclave (tough service). Our experience has been CONTINUOUS SMOOTH OPERATION for several years."

## An Instrument Co. writes—

"Control of gasoline pressure on flow range of 5-4000 p. p. h. at 17½ psi. CONSTANT PRESSURE CONTROL over full range within 5%. This was on production test stands used for checking solid fuel injection on aircraft motors."



WRITE FOR  
BULLETIN  
962

Note the benefits users say they get from their CASH STANDARD Type '1000' Pressure Reducing Valves.

## Check the benefits with this list

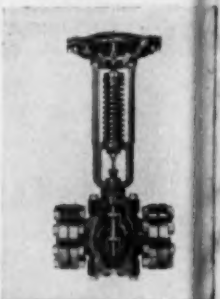
1. Maximum capacity when needed most.
2. Accurate pressure control under toughest working conditions.
3. Trouble-free service.
4. Smooth operation.
5. Tight closure.
6. Speedier production results.
7. Elimination of failures.
8. Cost-saving operation.
9. No spoilage.
10. Practically zero in maintenance.

BULLETINS  
AVAILABLE  
ON OTHER  
CASH STANDARD  
VALVES

Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers—various types for automatically operating valves, dampers, chockers, stokers, pulverizers, fans, and other apparatus. Its pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve—direct operated—direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

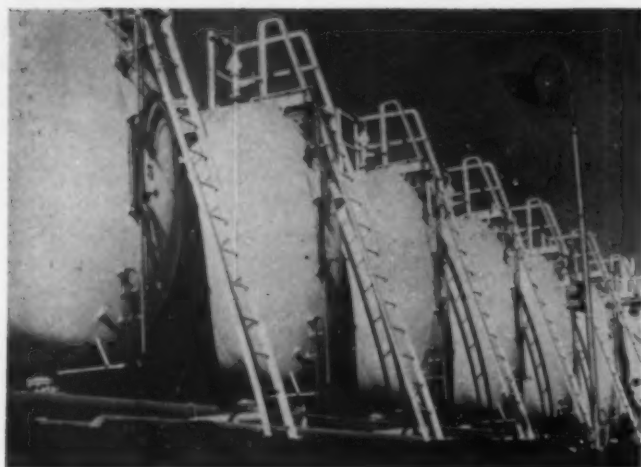


Bulletin 956 features the CASH STANDARD Type 4838 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

**CASH STANDARD**  
CONTROLS...  
VALVES

**A. W. CASH COMPANY**  
DECATUR, ILLINOIS





**1** Feed and product storage tanks of the mercaptan unit at Phillips' sulphur compounds plant contain  $H_2S$  and olefins as well as tertiary mercaptans.

#### THE PROCESS . . .

##### . . . CONSUMES

Hydrogen sulphide  
C-C<sub>12</sub> Olefins  
Air

##### . . . MAKES

Tertiary mercaptans  
Butyl      Octyl  
Amyl      Dodecyl  
Hexyl      Tetradecyl  
Hexadecyl

Ditertiary disulphides  
Butyl      Hexyl  
Amyl      Octyl  
Dodecyl

# Mercaptans & Disulphides



High purity tertiary mercaptans and disulphides are produced from hydrogen sulphide and olefins in the sulphur compounds plant of Phillips Petroleum Co. near Borger, Texas.

The Phillips process starts with the recovery, purification and liquefaction of hydrogen sulphide from residue gas and refinery vapors. Before it is compressed and liquefied, hydrogen sulphide is dried to a low dewpoint to minimize corrosion in the process equipment. Hydrocarbon feed consists of olefins of the desired molecular weight range. It is fractionated to a narrow boiling range to facilitate separation of unreacted olefins from the high purity mercaptan products. First step in the operation is the reaction of olefins and  $H_2S$  in catalyst cases.

Hydrogen sulphide is reacted with olefins at moderate temperatures and pressures over a suitable solid catalyst in the catalyst case to yield the desired mercaptans. In the manufacture of low molecular weight mercaptans, conversions of the olefin is essentially complete. An inert hydrocarbon diluent is also present. Separation of the solvent and the final purification of the mercaptan are described below.

The crude product goes to a high-pressure stripper which removes the excess  $H_2S$  for recycling. The product passes on to a low-pressure stripper where the light product is drawn off as overhead. The stripped product is passed to a recycle diluent tower. Here the overhead passes to a mercaptan fractionating unit. The bottoms of the recycle tower are returned to diluent storage.

Mercaptans are withdrawn from the mercaptan tower for sale, or they may be further oxidized to alkyl disulphides in the disulphide unit.

Production of heavy mercaptans, dodecyl and higher, takes place without a diluent. However, it is usually necessary to recover unreacted olefins from this process. In such cases an appropriate modification in the tower operation separates the unreacted olefins as the overhead and the mercaptans as the kettle product in the recycle diluent tower.

In the disulphide process unit an inert hydrocarbon diluent is also employed. Here the mercaptans are dissolved and passed over a solid oxidizing reagent. This takes place in the catalyst cases. Air is injected into the diluent-mercaptan stream prior to the oxidation. This is done to regenerate the reagent which is reduced during oxidation of the mercaptans. Water is a product of the mercaptan oxidation and is removed from the diluent disulphide stream by fractionation. This takes place in the water removal column where the diluent is separated and recovered as an overhead fraction and the desired product passes from the bottom of the unit to a surge tank or to a vacuum fractionating column where the desired disulphides are cut out and sent to storage.

A portion of the diluent-disulphide stream is fractionated continuously for disulphide and recycled solvent recovery. The remainder is recycled to the oxidation step after the addition of mercaptans, air and diluent make-up.

Disulphide fractionation is carried out to give products that meet rigid specifications covering the boiling range, flash point, color, odor and sulphur content.



**pipng repairs**  
**cost more**  
**now!**

**You make them less often**  
**by using Dependable Quality**  
**CRANE VALVES**

*...That's why  
more Crane Valves  
are used  
than any other make*

← **easy access prevents trouble with this valve**

Remove just two nuts to dismantle this gate valve for inspection, cleaning, or repairs—without taking it from the line. Reassemble just as easily, knowing that Crane clamp design keeps the bonnet joint snug and accurately aligned. Use Crane Clamp Gates on steam, water, and air, but especially in heavy fluid lines needing periodic cleanout. They'll save time, labor, and encourage regular servicing that prevents valve trouble.

Combining easy access with highly dependable service features, Crane Clamp Gates typify Crane Quality—better valve performance at lowest ultimate cost.

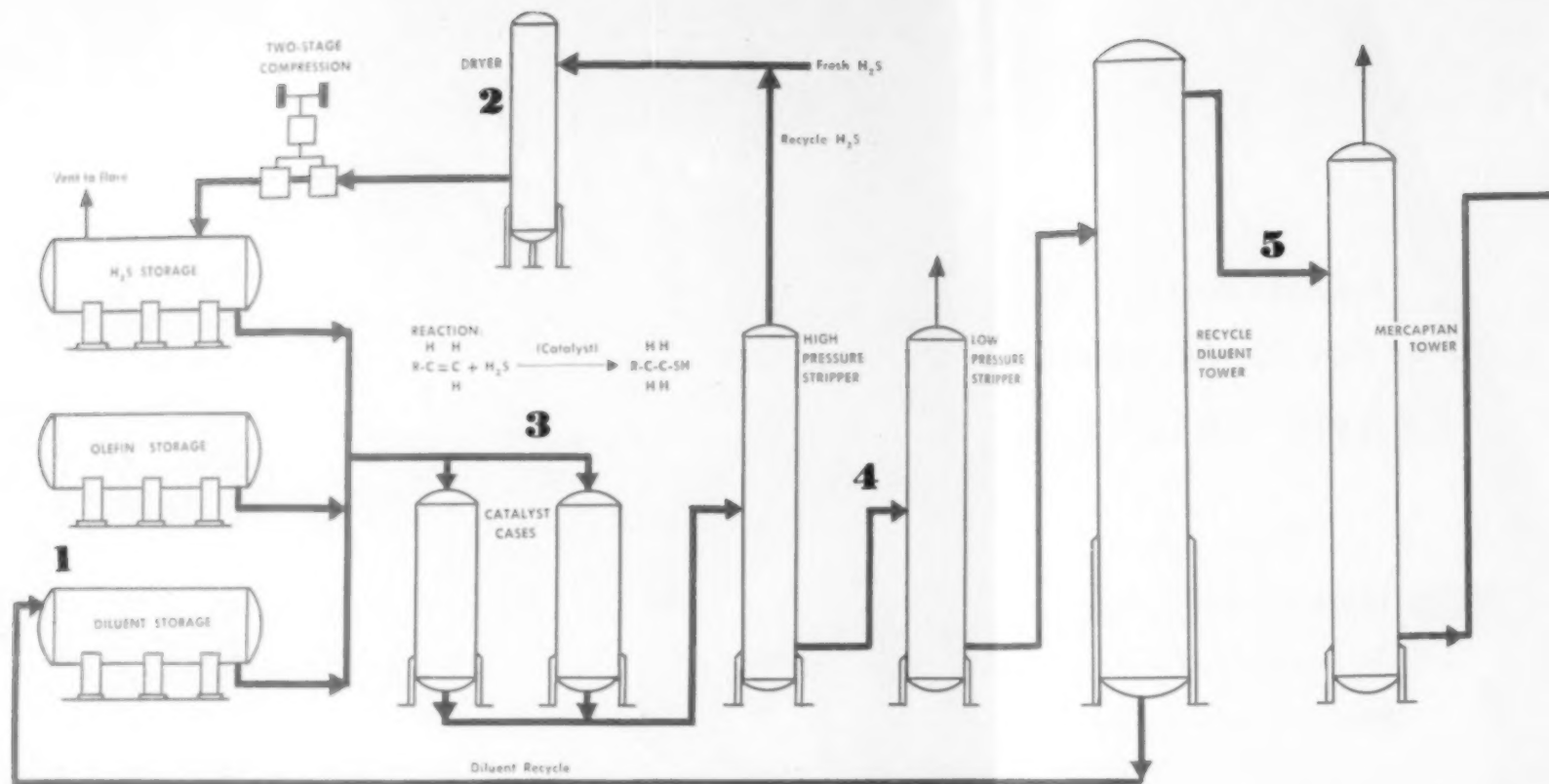
No. 488 Iron Body Clamp Gate

# CRANE

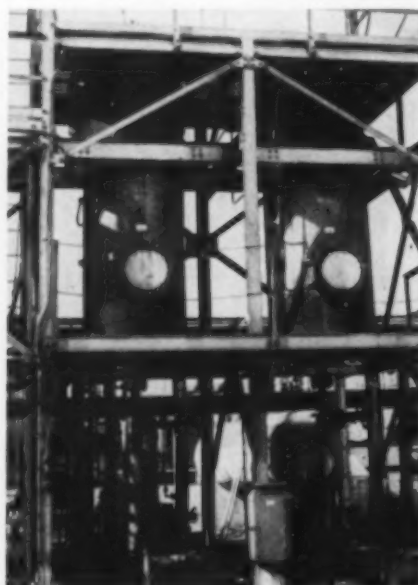
CRANE CO., General Offices:  
836 S. Michigan Ave., Chicago 5, Ill.  
*Branches and Wholesalers Serving All Industrial Areas*

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

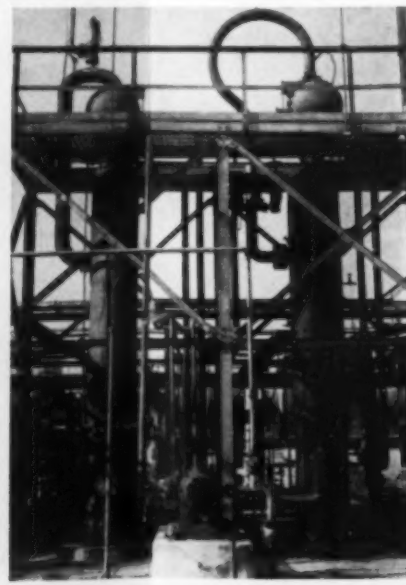
CHEMICAL ENGINEERING—March 1951



**2** DRYERS cut down dew point of hydrogen sulphide before compression and liquifaction.



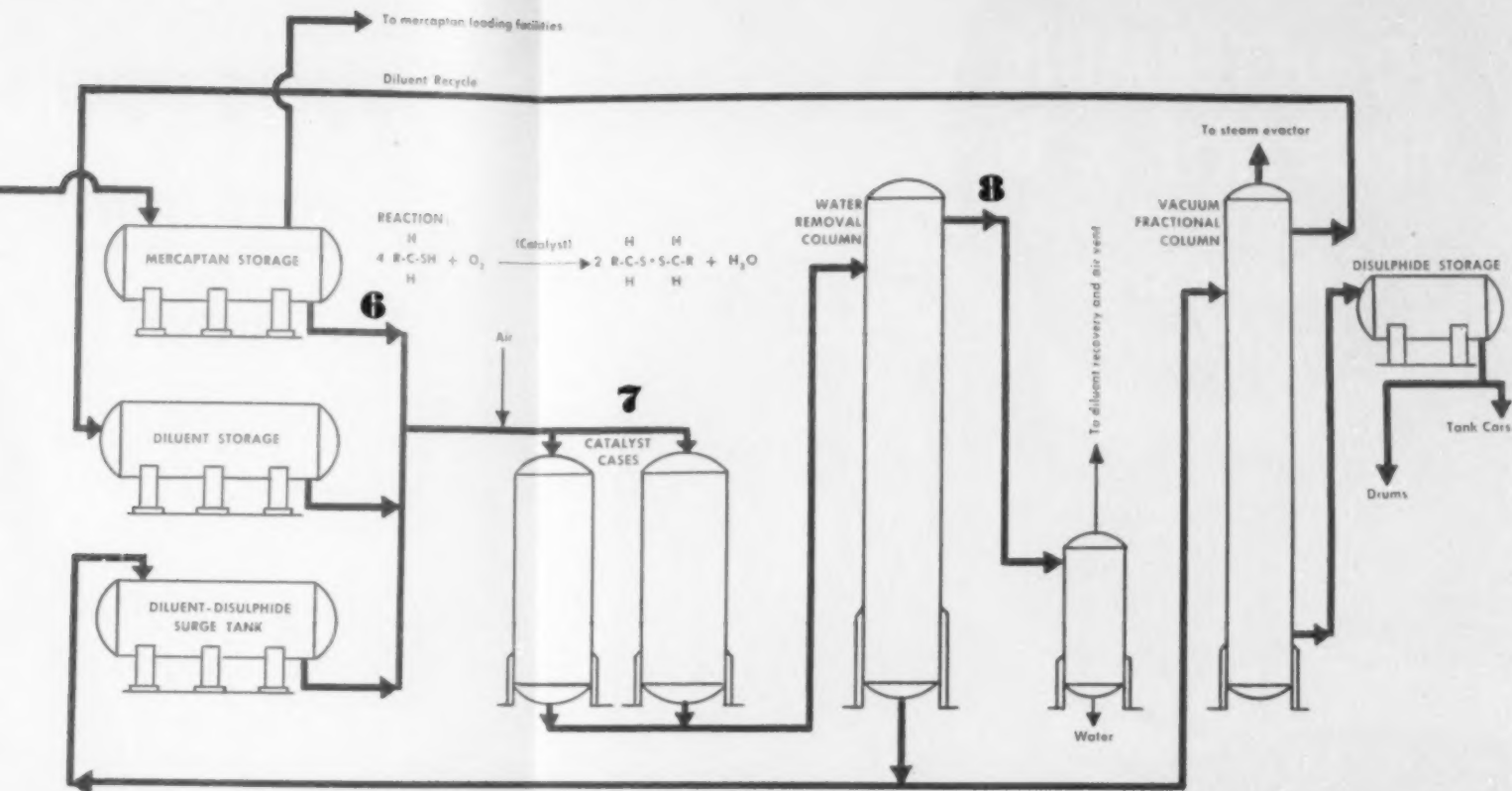
**3** CATALYST CASES where hydrogen sulphide and olefins react to form the mercaptans.



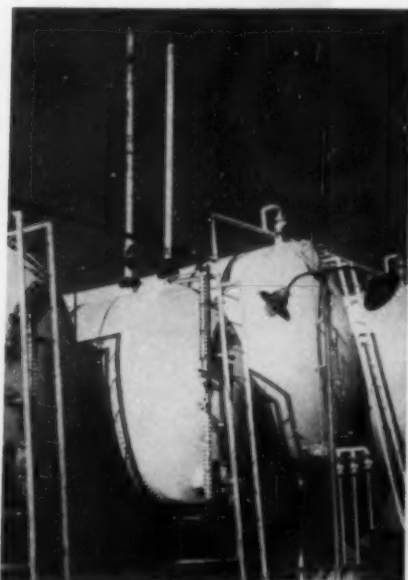
**4** STRIPPERS where unreacted H<sub>2</sub>S is recycled or vented to flare. High pressure unit on right.



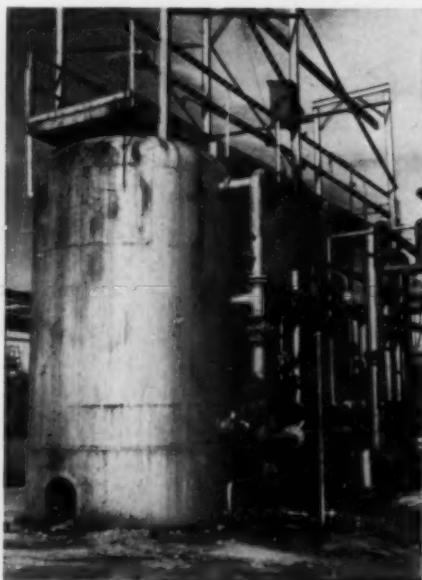
**5** TOWERS in mercaptan unit takes place in mercaptan tower.



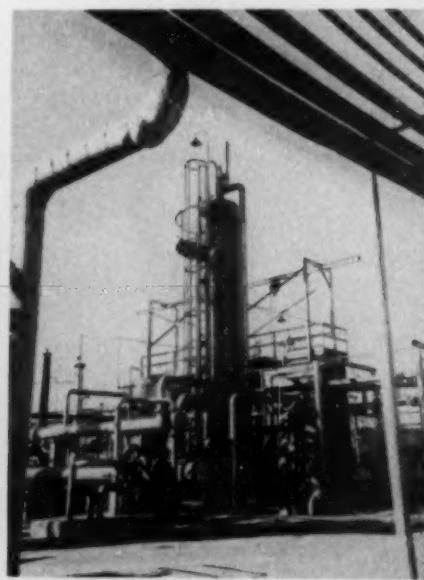
unit. Final purification tower at left.



**6** TANKS for disulphide unit store the raw material, recycle diluent, and products.



**7** CATALYST CASES where mercaptan is oxidized to disulphide. Air regenerates oxidizer.



**8** DISULPHIDE UNIT view shows water removal column next to catalyst cases.



# TO DETERMINE PROPER F x G

Tolhurst  
VARIABLE SPEED  
Centrifugals

ILLUSTRATION  
SHOWS HYDRAULIC  
DRIVING UNIT WITH  
COVER REMOVED



## Only Tolhurst Variable Speed Centrifugals provide

- ★ Smooth stepless speed variation from 0 to 2150 RPM
- ★ Centrifugal force range up to 1700 times gravity
- ★ Available with interchangeable baskets, perforate or imperforate, 20" and 26" diameters
- ★ Basket speed indicator is standard equipment
- ★ Case can be jacketed for circulating steam or coolant
- ★ Can be furnished completely fume tight, as illustrated
- ★ Single speed motor can be open, totally enclosed fan cooled or explosion proof, as specified

WRITE FOR ILLUSTRATED CATALOG

## TOLHURST CENTRIFUGALS

Division of AMERICAN MACHINE AND METALS, INC.  
EAST MOLINE, ILLINOIS

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1144 Weston Road, Toronto 9, Ontario

DO THESE 6 JOBS

*Faster...*

*More Economically*

FILTERING  
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### LABORATORY SERVICE AVAILABLE

TOLHURST MAINTAINS A WELL-QUALIFIED STAFF AND MODERN RESEARCH FACILITIES TO FURNISH CONFIDENTIAL, UNBIASED AND INTELLIGENT RECOMMENDATIONS ON YOUR CENTRIFUGAL PROBLEMS.

# pipng repairs

## cost more

## now!



No. 488 Iron Body Clamp Gate

# CRANE

VALVES • FITTINGS • PIPE • PL

CHEMICAL ENGINEERING—March 1951



**You make them less often  
by using Dependable Quality**

## **CRANE VALVES**

*...That's why  
more Crane Valves  
are used  
than any other make*

**easy access prevents trouble with this valve**

Remove just two nuts to dismantle this gate valve for inspection, cleaning, or repairs—without taking it from the line. Reassemble just as easily, knowing that Crane clamp design keeps the bonnet joint snug and accurately aligned. Use Crane Clamp Gates on steam, water, and air, but especially in heavy fluid lines needing periodic cleanout. They'll save time, labor, and encourage regular servicing that prevents valve trouble.

Combining easy access with highly dependable service features, Crane Clamp Gates typify Crane Quality—better valve performance at lowest ultimate cost.

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836 S. Michigan Ave., Chicago 5, Ill.  
Branches and Wholesalers Serving All Industrial Areas

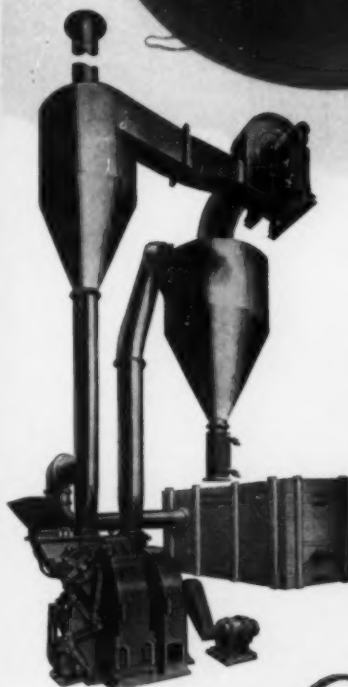
**PLUMBING • HEATING**

# **RAYMOND**

# *Flash-Drying*

**WET TO DRY - COARSE TO FINE**

**--- a Versatile  
System for  
the Chemical  
and Process  
INDUSTRIES**



**...ensuring Close  
Product Control  
in Moisture  
Fineness  
Uniformity**

IF you are handicapped by high costs in making the finer grades of powdered materials, the Flash-Drying-Equipped Raymond Imp Mill can help you modernize and economize your methods of production.

It shortens the processing time by combining all operations in a single unit of equipment . . . drying, grinding, classifying are simultaneously performed . . . no dust, waste or loss of material.

Simple adjustments make it easy to maintain consistent uniformity of the finished product to meet exacting specifications. The removal of moisture while pulverizing results in large savings on such materials as chemicals, pigments, filter-cakes, centrifuged products and foods.

Refer your problem to Raymond engineers and get the benefit of their wide experience in flash-drying applications.

**COMBUSTION ENGINEERING-SUPERHEATER, INC.**  
*Raymond*  
**PULVERIZER DIVISION**

**1311 NORTH BRANCH ST  
CHICAGO 22, ILLINOIS**



Sales Offices in Principal Cities



**pipings repairs**  
**cost more**  
**now!**

**You make them less often**  
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**CRANE VALVES**

*...That's why  
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# CRANE

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

CHEMICAL ENGINEERING—March 1951

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## Chemical Engineering News

(Continued from page 128)

This floated concentrate is de-watered in a solid bowl continuous centrifuge. Dried solids pass to the sulphur melting pit. Free acidity is neutralized with lime, and molten sulphur from the pit is filtered in a steam-heated leaf filter. Cake is returned to the slurring step for reworking. The filtrate is the product—99.5 percent sulphur.

**High Recovery.** The new Chemico process extracts substantially all the sulphur from an ore. From a single cycle, recovery is 90 percent or better. And the product is commercially pure sulphur, its purity 99-100 percent. Ore containing as little as 20 percent sulphur can be processed.

Earlier processes for separating sulphur from ores by simple melting and agglomeration haven't panned out commercially, especially with ores containing finely distributed sulphur. What's more, recovery of sulphur by these processes seldom exceeds 50-75 percent; even with the best ores, a recovery of about 80 percent is tops.

One big reason for the low recovery of sulphur by the earlier processes is this: part of the molten sulphur is held in the interstices of the gangue. The new process, while it still uses agglomeration separation as much as the ore permits, also separates sulphur from the gangue by an improved froth flotation method.

Previous commercial attempts to get sulphur out of ground ore by froth flotation have been snagged by the presence of finely divided sulphur in the ore. During grinding, much of the free sulphur in the ore disintegrates into fine particles; during flotation, these particles attach themselves to the bubbles of froth. By coating the bubbles, these fines stabilize the froth so that it cannot release gangue particles. This makes the flotation less selective and lowers the grade of the concentrate.

The new process overcomes these difficulties and recovers a high percentage of pure sulphur by first heating and agitating an aqueous slurry of the ground ore for a short time at a temperature above the melting point of sulphur, thus causing the fine particles to coalesce into larger aggregates with less exposed surface.

**Surface Deposits.** Vast supplies of ore that can be mined from the surface are found all over the world. Any ore containing free sulphur can be treated by the Chemico process. All known major deposits in the United States, as well as ores from such countries as South America, Egypt, Greece, Turkey, Japan and India, have been sampled. In the largest deposits, the gangue in the ores is silica. Some important deposits, however, contain calcium sulphate and calcium carbonate gangues.

Largest known deposits are in the Andes mountains in South America. It's estimated that these, stretching the full 3,000-mi. length of the Andes, contain upwards of 100 million tons of elemental sulphur. In the western United States, where there are millions of tons of surface sulphur, the most important deposits are in California and northwestern Wyoming.

**Competitive With Frasch.** Chemico claims it can process ore containing over 30 percent of the free element and produce a 99.5 percent sulphur for a net cost at the mine of \$15 to \$18 a ton. A while back, the price of crude Frasch sulphur at the mine was boosted from \$18 to \$22 per ton. Thus, in the western states at least,

the Chemico process should be competitive, since it costs money to ship sulphur out there from Frasch mines on the Gulf Coast. What's more, the Gulf Coast deposits that can be mined by the Frasch method, long the world's prime source of sulphur, are dwindling.

A turnkey plant in the western United States, processing 35 percent ore to produce 200 tons a day of 99-100 percent pure elemental sulphur, would cost \$1.4 million. So estimates Chemico's Thomas P. Forbath. Operating costs, including mining, direct labor and materials for processing, would be about \$12 per ton of sulphur recovered. At present tax rates, the plant would pay for itself in four years out of net profits after taxes. All in all, the Chemico process looks like a strong contender in the current sulphur crisis.

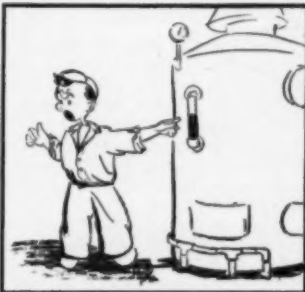
### Tetraiodide Process Yields Ductile Zirconium for AEC

Ductile zirconium is being produced by Foote Mineral Co. for experimental work by the U. S. Atomic Energy Commission. Zirconium has little tendency to capture neutrons. Hence it's well adapted for use in atomic furnaces. Foote has been making the ductile metal commercially since 1942.

In the Foote process, zircon (zirconium orthosilicate,  $ZrSiO_4$ ) and carbon are charged to a furnace. Silica from the orthosilicate volatilizes in the reducing atmosphere and at the furnace temperature. This leaves zirconia ( $ZrO_2$ ), which reacts with the carbon,

(Continued)

### LITTLE BONERS



#### Stratified Carbon

The Dowtherm boiler at a small plant in California had been operating very well for several months at full pressure and capacity. One day an operator noticed that the liquid in the

sight glass had darkened. It even appeared to have small black particles suspended in it.

An operating foreman, examining a sample under a magnifying lens, exclaimed: "Stratified carbon! It's definitely a case of Dowtherm breakdown." That was possible, for at times the boiler had been operated well above its rated capacity.

So the boiler was shut down. Sure enough, when the condensate tank was drained several large pieces of "carbon" were found. But one piece still had iron brackets attached to it!

When the tank was opened up, there was the rest of the ladder that some construction worker forgot to take out.

Do you know of a "Little Boner" that actually happened? Then why not send it to the Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.? We won't reveal any identities!

News, cont. . .

and sometimes with nitrogen from the atmosphere, to produce a compound that is next chlorinated to form zirconium tetrachloride. The tetrachloride is reduced with molten magnesium to sponge zirconium. Sponge

metal is then reacted with iodine under vacuum to form the tetraiodide of the metal, which is decomposed thermally to produce ductile zirconium crystal bars.

Big headache for the metallurgists has been that all metals with the strength, resistance to corrosion

and high-temperature characteristics needed in materials of construction for atomic reactors have also possessed lusty appetites for neutrons. To solve their problem they had to search for a new metal, one that wouldn't capture neutrons. Their hunt led to zirconium.



## Illini to Dedicate New Laboratory

The new East Chemistry Building at the University of Illinois in Urbana, housing the Divisions of Chemical Engineering and Biochemistry, will be dedicated on Friday afternoon, March 30, to the memory of Samuel Wilson Parr, pioneer chemical engineering educator, who came to the University of Illinois as professor of applied chemistry in January 1891 and who, 10 years later, introduced the first chemical engineering curriculum at the university. A bronze plaque commemorating Parr will be installed in the lobby of the new building. The formal dedication is part of a two-day program, March 30-31, that will bring outstanding chemists and chemical engineers among the alumni back to the Illinois campus.

President George D. Stoddard of the university will respond to the action of the Board of Trustees at the formal dedication ceremony, and Roger Adams, head of the Chemistry Department, will deliver an address.

Principal speakers at the dedication banquet in the Illini Union Ballroom the same evening will be two former members of the faculty of the Chemistry Department. Donald B. Keyes of Heyden Chemical Corp. will review "Fifty Years of Chemical Engineering in University and Industry," and Howard B. Lewis, professor of biological chemistry at the University of Michi-

gan, will look back over a "Half Century of Biochemistry."

Toastmaster at this banquet will be Sidney D. Kirkpatrick, editorial director of *Chemical Engineering* and *Chemical Industries Week* and vice president of the McGraw-Hill Book Co. An alumnus of the Department of Chemistry at Illinois, Kirkpatrick is also a director of the University of Illinois Foundation. It was he who first proposed that the East Chemistry Building be dedicated to the late Prof. Parr.

Two scientific programs will be held on Saturday, March 31, as added features of the two-day event. H. Fraser Johnstone, professor of chemical engineering, will preside at the one on chemical engineering, while William C. Rose, professor of biochemistry, will be chairman of the session on biochemistry.

Each speaker at these scientific sessions is the holder of either a B.S., M.S. or Ph. D. from Illinois. The occasion will constitute a homecoming of chemical and chemical engineering alumni and graduate students to the campus.

At the chemical engineering program, Edwin R. Gilliland, professor of chemical engineering at MIT, will discuss "The Mixing of Gases and Solids in Beds of Fluidized Solids"; Robert L. Pigford, chairman of the

Department of Chemical Engineering at the University of Delaware, will explore "Mathematical Techniques in Chemical Engineering Research"; Norman W. Krase of the development department of E. I. du Pont de Nemours & Co. will review "Accomplishments and Prospects of High-Pressure Technology"; and William L. Faith, director of engineering for the chemical division of Corn Products Refining Co., will report on "Process Development in the Food and Agricultural Industries."

Edward A. Doisy, director of the Department of Biochemistry in the School of Medicine at St. Louis University, will lead off the session on biochemistry with a consideration of "Some Aspects of Steroid Metabolism." Wendell H. Griffith, chairman of the Department of Biological Chemistry and Nutrition in the School of Medicine at the University of Texas, will discuss "The Effect of Individual Amino Acids on the Requirement of Choline." Vincent du Vigneaud, head of the Department of Biochemistry in the College of Medicine at Cornell University, will report on "Transmethylation and the Biological Synthesis of the Labile Methyl Group." And "The Role of Biochemistry in Industry" will be presented by Thomas R. Head, who is the head of the veter-

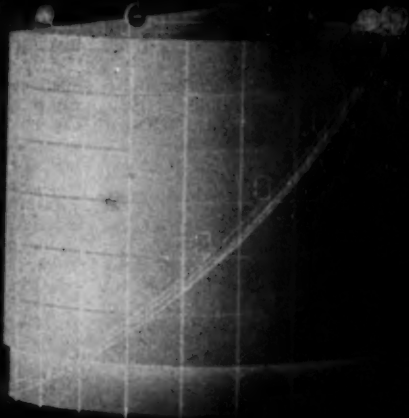
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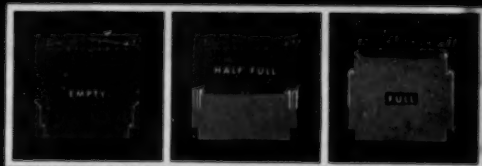
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News, cont. . .

inary biological section in the Grasselli Chemicals Department of E. I. du Pont de Nemours & Co.

The present East Chemistry Building, completed in the spring of 1950, is a five-story building. In addition, it has a sub-basement, basement and a penthouse. These contain principally machinery.

The Division of Chemical Engineering occupies, for the most part, the ground floor and the next two upper ones, while the Division of Biochemistry is housed on the two top floors. Headroom for equipment of the Chemical Engineering Division extends through the two floors of the Biochemistry Division, permitting a 70-ft. tower.

The Biochemistry Division has a room in the chemical engineering area of the building for large-scale preparations.

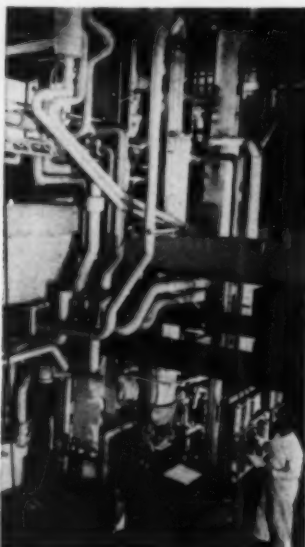
Atop the huge building, the penthouse contains air-conditioning equipment, apparatus for distilling water, elevator machinery, compressed air machines, fans for hoods and other mechanical devices.

The two basements are also filled with mechanical devices. Services include cold water, hot softened water, steam at three pressures, distilled water, condensate lines, vacuum, compressed air and gas.

The new building occupies a quarter of a block southeast of Noyes Laboratory of Chemistry and east of Chemistry Annex, adjoining Davenport Hall.

East Chemistry is connected to Noyes Laboratory and the Chemistry Annex by a subway beneath Mathews Ave.

The new East Chemistry Building cost \$3.5 million, its equipment another \$400,000. This is exclusive of the ground itself, which was turned over to the university by the State of Illinois after its acquisition. The Illinois General Assembly made three different appropriations for the erection of the structure. Thus in its 50th anniversary year, the Division of Chemical Engineering at the University of Illinois, together with the Biochemistry Division, moves into its new home dedicated to the man who inaugurated the university's chemical engineering curriculum, Samuel Wilson Parr.



## GAF Tames Acetylene

Its exploration of the reactions of acetylene at high temperatures and high pressures is beginning to pay off for General Aniline & Film Corp. At its Grasselli, N. J., plant, GAF has gone to 3,000 psi. in some acetylene reactions, has furthered the pioneering work of I. G. Farben's Dr. J. Walter Reppe, has come up with vinylators and high-vacuum stills of improved design. A whole host of acetylene derivatives is being produced. One that's getting into volume production is polyvinylpyrrolidone. It's a blood plasma substitute and a powerful de-

toxifying agent when combined with iodine.

Right now, General Aniline makes a little over 1,000 lb. a month of polyvinylpyrrolidone or PVP. By May it will be making 15,000 lb. a month, and by January next year it hopes to be turning out about 60,000 lb. a month of PVP. This spurt will come from over-all expansion at Grasselli; production of all acetylene derivatives will benefit.

General Aniline currently gets its acetylene from calcium carbide derived from coal and limestone. But acety-

lene from natural gas cannot be discounted in sizing up future plans.

In making polyvinylpyrrolidone at Grasselli, acetylene is condensed with formaldehyde (1 mole of acetylene to 2 moles of formaldehyde) so that the triple bond of acetylene remains intact. This ethynylation takes place behind barricades and armor plate at 150 psi. or higher. A copper acetylide catalyst is used. It's on a silica carrier and contains bismuth to prevent formation of cuprene. Products are degassed, any unchanged formaldehyde and propargyl alcohol distilled off, and the main product, butynediol, recovered.

Next, the butynediol is hydrogenated at 5,000 psi., using a Cu-Ni-Mn catalyst, to butanediol. The butanediol is distilled in a stainless steel high-vacuum still operating at as low as 1 mm. Then it is dehydrogenated at elevated temperature in the presence of a copper catalyst on pumice to form the ring compound butyrolactone.

Ammonolysis at high temperature and high pressure converts the butyrolactone to pyrrolidone. This is vinylated at 230 psi. in the presence of potassium hydroxide to produce vinyl pyrrolidone. The monomer is carefully purified in high-vacuum stills before it is polymerized, using a hydrogen peroxide catalyst, to produce PVP. Spray drying the aqueous solution of the polymer completes the process. The polyvinylpyrrolidone used as a blood plasma substitute ranges from 40,000 to 50,000 in molecular weight.

By all odds the most promising industrial organic that GAF is making from acetylene at the moment is butanediol itself. It has great possibilities in plasticizers for synthetic fibers.

(Continued)

# Famous Brands in the Southwest



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Realizing that low-cost transmission of natural gas, from its source on the Gulf Coast to the Northern and Eastern seaboard was vital to America's well-being, Texas Eastern Transmission Corporation purchased the Big Inch and the Little Big Inch Pipe Lines from the Government and converted them from oil and gasoline transmission to gas. The conversion contract was awarded to Brown & Root, Inc., who has done an outstanding job of converting and expanding this vast system.

The Brown & Root staff of specialists makes possible a completely integrated service, including plant location, thorough planning and supervision of construction, and delivery of a ready-to-operate plant, all under one contract . . . one responsibility. If your company's plan calls for new construction or expansion, at your invitation a Brown & Root expert will gladly make a complete survey for you. Why not call or write today; there is, of course, no obligation involved.



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News, cont. . .

Other chemicals with bright futures are methyl vinyl ether, now being made in tank-car quantities at Grasselli and shipped to a pharmaceutical manufacturer for use in a sulfa drug, and the polyvinyl ethers. Polyvinyl methyl ether is soluble in cold water and insoluble in hot water (above 95 deg. F.); rubber manufacturers use it to precipitate latex at low temperature. And polyvinyl isobutyl ether is finding use in pressure-sensitive adhesives. General Aniline also produces and sells Koresin, a tackifier for synthetic rubber. It's made from alkylated phenol and acetylene. All in all, GAF is out in front in the fast-moving field of high-temperature high-pressure acetylene chemistry.

## Bureau to Try New Methods Of Gasifying Coal in Ground

More than two years of experiments by the Bureau of Mines and the Alabama Power Co. at Gorgas, Ala., show that gases resulting from burning unmined coal may offer a low-cost fuel for generating power. A gas turbine driven by hot product gas from the underground burning of coal was operated at Gorgas for a short time, for the first time in this country.

Meanwhile, plans are afoot for a new experiment at Gorgas in converting coal into gas underground. This project is an attempt to utilize coal without mining it. One of the objectives is production of synthesis gas or hydrogen, a preliminary, and up to now relatively expensive, step in converting coal to gasoline, oil and chemicals.

About 8,000 tons of coal underlying between one and two acres of ground at Gorgas have been burned so far from a single initial passage prepared at the start of the experiment. Entries were driven into a coal bed and connected to the surface by large boreholes through which air was admitted and the product gases withdrawn. No difficulty was found in burning the coal from an initial underground opening, and in conducting subsequent operations from the surface.

Among other things, the test program at Gorgas has demonstrated that a hot gas suitable for operating a boiler or a gas turbine can be produced continuously by burning coal in place. Temperatures above 2,000 deg. F. are readily achieved. In one section, operated for 16 months, the total heat in the gas reached a maximum for the eighth month of about 70 percent of the heating value of the coal consumed. Gas with a heating value up to 150 Btu. per cu. ft. was obtained

for short periods and gas of 40 to 80 Btu. was produced for periods up to eight or 10 days, the heating value deteriorating after that time.

For the new experiment, it is proposed to open up a deeper coal seam, using electrical or hydraulic methods of opening passages between vertical boreholes. The new procedure is expected to improve the contact between the air and the coal faces underground and permit better control. If this is successful, it will be possible to produce a gas of relatively high heating value (80 to 100 Btu. per cu. ft.) without deterioration after a few days of  
(Continued)

#### CONVENTION CALENDAR

Commercial Chemical Development Association, annual meeting, Roosevelt Hotel, New York, March 20-21.  
American Chemical Society, 119th national meeting, Boston, April 1-5.  
American Pharmaceutical Manufacturers Association, annual meeting, Boca Raton Club, Boca Raton, Fla., April 2-4.  
American Society of Mechanical Engineers, spring meeting, Atlanta Biltmore Hotel, Atlanta, April 2-5.  
National Agricultural Chemicals Association, spring meeting, Flamingo Hotel, Miami Beach, Fla., April 4-6.  
Electrochemical Society, Washington, D. C., April 8-12.  
American Chemical Society, 119th national meeting, Cleveland, April 8-12.  
American Society of Lubrication Engineers, annual convention and Lubrication Show, Bellevue-Stratford Hotel, Philadelphia, April 16-18.  
Association of Consulting Chemists & Chemical Engineers, Shelburne Hotel, New York, April 24.  
Society of Chemical Industry, Perkin Medal Award, New York, April 27.  
Catalysis Club of Philadelphia, Third Symposium on Catalysis and Reaction Mechanisms, Engineering Building, Room 314, Philadelphia, April 28.  
American Petroleum Institute, Division of Refining, 16th mid-year meeting, Mayo Hotel, Tulsa, Okla., April 30-May 3.  
American Oil Chemists' Society, 42nd annual meeting, Hotel Roosevelt, New Orleans, May 1-3.  
American Institute of Chemists, annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, May 9-11.  
Armed Forces Chemical Association, annual meeting, Claridge Hotel, Atlantic City, May 10-12.  
American Institute of Chemical Engineers, regional meeting, French Lick Springs Hotel, French Lick, Ind., May 11-14.  
American Institute of Chemical Engineers, regional meeting, Hotel Muehlebach, Kansas City, May 13-16.  
Society of Cosmetic Chemists, semi-annual technical meeting, Biltmore Hotel, New York, May 18.  
Society of the Plastics Industry, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., May 24-25.

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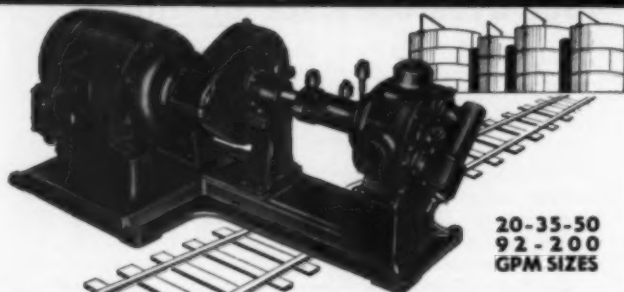
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NEWS, cont. . .

operation, thus overcoming the difficulty encountered in previous experiments. Construction of the new unit is under way.

Pioneer work on the electrical method already conducted in this country by the Sinclair Coal Co. and the Missouri School of Mines has shown that connections can be made underground without manual driving of entries.

### Refinery Processes Wastes Into Salable Fertilizer

Turning two refinery waste products into a profitable chemical by-product is a neat trick. That's just what General Petroleum Corp. is doing at its Torrance, Calif., refinery. A nitrogenous component of waste refinery gases is reacted with sulphuric acid sludge to produce ammonium sulphate fertilizer. This project cost over \$250,000 to complete.

The new process starts with the nitrogenous component of the waste refinery gases; this is bubbled through acid sludge, producing a solution of ammonium sulphate. Crystals are formed in the liquid by partial evaporation.

Resulting ammonium sulphate crystals are separated by a centrifuge and blown into a hopper from which trucks can be loaded by gravity. The crystals contain over 20.9 percent nitrogen.

Unique feature of the process is that instead of using pure sulphuric acid—a critical defense material currently in short supply—the unit uses acid sludge, another refinery waste. Getting rid of acid sludge has always been a tough and expensive disposal job at refineries.

Fluor Corp. of Los Angeles engineered and constructed the new unit.

Entire output of the new unit has been contracted for by the California Farm Bureau Federation, a cooperative buying organization of California farmers. The plant produces 11 tons of ammonium sulphate daily.

### Kaiser to Make Magnesium Using Pidgeon Process

Magnesium will be made by the Pidgeon ferrosilicon process at the Manteca, Calif., plant that Kaiser Magnesium Co. is now reactivating. Kaiser Magnesium is a wholly owned subsidiary of Kaiser Aluminum & Chemical Corp. About \$700,000 is being spent to get the plant back in shape. When it gets going, probably this summer, it will produce magne-



sium at a rate of 20 million pounds a year.

An estimated \$1.7 million is being spent to expand the parent company's dolomite plant at Natividad, Calif., and its ferrosilicon plant at Permanente, Calif., since both materials will be needed at Manteca for production of magnesium by the Pidgeon ferrosilicon process.

In the new operation, 4½ parts of calcined dolomite will be mixed with 1 part of ferrosilicon and pelleted. The pellets will be charged into alloy steel retorts, 10 ft. long and 10 in. in diameter, which are then sealed and exhausted of air. At 2,140 deg. F., produced in the chambers by gas-fired burners, metallic magnesium vapor forms. It is condensed as crystals and then melted into ingots. All told, there are 1,024 retorts, each of the 64 brick furnaces having 16 retorts.

Permanente Metals Co. operated the Manteca plant for two years during World War II. Before it closed in 1944 it produced over 24 million pounds of magnesium.

#### OTS Safeguards Voluntary On Technical Information

A program for the voluntary safeguarding of technical information has been set up by Secretary of Commerce Charles Sawyer. The Office of Technical Services, under Director John C. Green, has been designated by Secretary Sawyer to act as a clearing house in this voluntary program for protecting technical information. No formal security restrictions will be imposed, however.

Industrialists, businessmen, scientists, public officials and private citizens can use this service to determine whether technical information in their possession should be disclosed. They can send their inquiry, together with manuscripts, plans or documents, to the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

OTS will refer inquiries to one or more agencies expert in the particular field, assemble the comments, and forward the government's advice, together with any original materials submitted by the inquirers.

But under no circumstances is a person who requests guidance required to accept the government's advice about the disclosure of unclassified information. Each individual possessing knowledge or information is the final judge of what is in the public interest. He may or may not act on the government's suggestion.

The program is primarily concerned  
(Continued)

## Rubber-base (Parlon®) Paints GIVE EXTRA PROTECTION against Acids and Alkalies



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More than 500 paint manufacturers now offer one or more rubber-base paints made with chlorinated rubber. These maintenance paints may cost a little more per gallon, but usually cost far less per square foot per year. We'll be glad to supply the names of several firms in your locality who can advise you.

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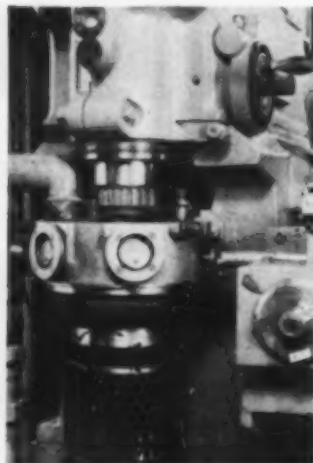
Send further details on "Parlon" paints and names of suppliers.

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_

CRS1-1

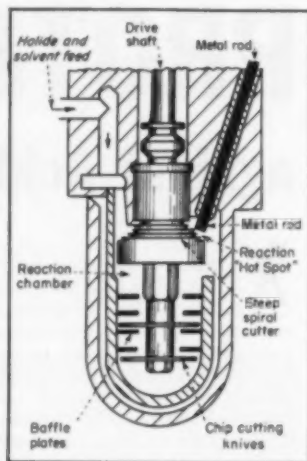
News, cont. . .

with unclassified information, particularly with advanced industrial developments, production know-how and technology, strategic equipment and special installations.



There's one important stipulation. Persons in a position to release unclassified technical information will not normally call on OTS for guidance on the release of this information to known representatives of recognized newspapers, press associations, radio

networks, scientific and technical journals. Most of these organizations have wide experience in safeguarding such material. However, the service will be available to both the editor and the source of the material if they want to use it.



## Metal Cutting: A New Unit Operation

The Cimmac reactor makes metal cutting a unique production tool for the chemical engineer. It's now available in commercial sizes.

Basically, the Cimmac reactor is a descendant of the lathe: a special machine for cutting metals such as aluminum, magnesium and zinc—but in the presence of liquid chemical reactants.

At the surface of the metal being turned the reactor creates (1) local high pressures, (2) local high temperatures, (3) highly stressed nascent metal surfaces—all of which promote reaction of the metal with the organic liquids present at the cutting point.

For reacting many organic compounds with metals, the Cimmac reactor has a clear-cut edge over the conventional methods. It permits either batch or continuous operations; makes it easy to start the reaction and, once started, easy to control it; reduces fire, explosion and toxicity hazards; gives greater output.

First commercial Cimmac unit is now in operation at Carlisle Chemical Works, Reading, Ohio. The technique and machine were developed by Carlisle and Cincinnati Milling Machine Co., of which Carlisle is a subsidiary. Carlisle is now ready to license

the technique—which it calls "mechanical activation"—while Cincinnati Milling will manufacture commercial units on a custom-design basis (several large chemical firms have already bought laboratory models).

Principle of the Cimmac "mechanical activation" reactor is simple (see drawing): a metal rod is fed mechanically against a rotating spiral cutter set in an autoclave filled with liquid reactants. The autoclave chamber has stationary baffles between which knife-edge vanes rotate. The chamber is removable, can be designed for batch or continuous operations.

In operation, the chemical fluid at the cutting point is subjected to high local pressure (depending on the hardness of the metal being cut), to high local temperatures (limited only by the melting point of the work material), and to nascent, highly stressed metal surfaces. Since the chemical reaction takes place largely at this small "hot spot" zone, there's no chance that it can get beyond control. Baffles and rotating knife-edge vanes provide agitation and further disintegration of metal chips. The reaction chamber is also fitted with a reflux condenser, inlet for inert gas, heater wells and a thermocouple well.

Carlisle has shown that the metal-cutting or mechanical activation principle may well become an important tool for producing many synthetic organics on a continuous, mass production basis. Here are typical reactions that are facilitated by the Cimmac reactor:

(1) Preparation of Grignard reagents and other organometallic compounds.

(2) Barbier-type reaction in which a secondary reactant is present during the formation of the Grignard reagent. Example: preparation of tertiary alcohols from ketones and an organic halide.

(3) Reformatski reaction for preparing beta-hydroxy esters or interaction of alpha-halogenated esters with carbonyl compounds and metals (usually Zn or Mg).

(4) Preparation of metal alkoxides: aluminum, magnesium and other alkoxides or alcoholates—often without a catalyst.

(5) Coupling reactions: Wurtz-Fittig, Ullman, Frankland, Sandmeyer (with nitriles), Guterman.

(6) Metal reductions with iron or zinc (Clemmensen).

(7) Catalytic hydrogenation and polymerization.

## Allied to Erect Coke Ovens At U. S. Steel's New Works

United States Steel Co. has awarded a contract to the Wilputte Coke Oven Division of Allied Chemical & Dye Corp. for designing, furnishing and erecting two coke-oven batteries of 87 ovens each at the Fairless Works of U.S. Steel near Morrisville, Pa. The new ovens will be Wilputte underjet, four-divided, low-differential coke ovens. Their combined annual capacity will be 916,000 net tons of coke. In addition, they'll produce large quantities of gas and valuable byproduct chemicals.

The installation will be complete with coal and coke handling equipment and byproduct recovery facilities. Ovens will be equipped with self-sealing hydraulically-operated  
(Continued)



## Another **LIQUID HAULING PROBLEM** with **FRUEHAUF TANK-TRAILERS**

### **BUNKER C OIL TANK-TRAILER**

Capacity 4500 gallons. Single compartment. Specialized equipment includes a six inch shore pipe discharge. Six inch gate valve with 6 inch internal wheel valve. Special Bunker C type manhole and venting. This unit is equipped with Fruehauf's "Multi-Rate" Suspenders on.



### **FRUEHAUF has, or can build, a TANK-TRAILER for every liquid hauling need!**

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A new and comprehensive guide-book on Tank-Trailers is available upon request. It illustrates and describes many chemical hauling units as well as the standard line of Fruehauf Tank-Trailers.

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FRUEHAUF TRAILER COMPANY**

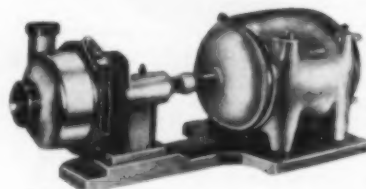
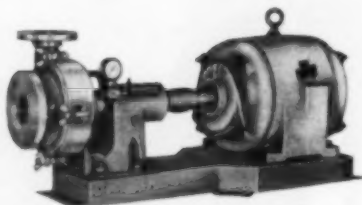
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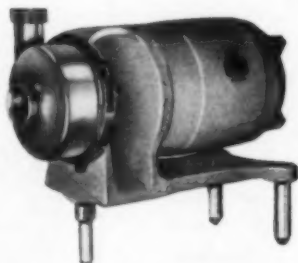
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**Tri-Clover STANDARD SERIES SANITARY TYPE.** This model has been designed for the non-agitating, efficient pumping of milk, food products such as diced carrots, cream style corn, tomatoes, applesauce, relish and beverages. It is also practical in breweries and for the pumping of drugs and chemicals in solution.

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News, cont. . .

equipment in the future, the ovens can be underfired with blast furnace gas, which will be generated at the two large blast furnaces to be erected at the Fairless Works.

### Ilmenite Smelting Process Successful in Pilot Plant

The Bureau of Mines thinks its successful electric-furnace smelting of ilmenite to produce a titanium-rich slag and marketable pig iron is good enough to warrant further investigation and ultimate commercial use of the process.

Results of pilot-plant tests made in the Bureau's electrometallurgical laboratory at Boulder City, Nev., under a cooperative agreement with National Lead Co. have now been reported.

About 15 tons of slag containing 6 percent titanium dioxide was produced from an ore containing about 30 to 45 percent titanium, resulting in a material suitable for the production of titanium dioxide pigment.

Smelting the ore also produces pig iron instead of the hard-to-market ferrous sulphate that would have resulted if the ore had been treated chemically, Bureau engineers report.

### Du Pont Unit Will Use New Hydrogen Peroxide Process

An improved process for the commercial production of hydrogen peroxide has been developed by E. I. du Pont de Nemours & Co., Inc., after six years of research. The first production unit will be built at Memphis, Tenn., at the same site where Du Pont is just starting to erect a unit for the production of sodium cyanide.

Du Pont has long been a producer of hydrogen peroxide at its Niagara Falls and Dresden, N. Y., plants. Hydrogen peroxide is widely used in the textile, paper, and rubber industries. It is important to the textile industry for the bleaching of cotton, wool, silk, rayon, linen, and other natural and synthetic fibers. Du Pont, within the last 10 years, has developed its use extensively as a bleach for paper pulps.

This is the first hydrogen peroxide plant to be built in the South, where use of peroxide has had its greatest development and growth in the textile field. The Memphis site was picked with an eye on this market.

The new unit will be built on the 225-acre site about 10 mi. north of the Memphis business center. Building of the first unit, the sodium cyanide plant, was started last November.

Both units will be operated by Du

Pont's Electrochemicals Department. James J. McIntyre, who will be manager of the Memphis plant, says both are expected to be completed and ready for production before the end of 1952.

"The hydrogen peroxide unit will employ about 75 persons when it starts operating and this will be in addition to about 180 needed for the manufacture here of sodium cyanide," McIntyre says.

Du Pont's Engineering Department is directing construction. About 700 local workers will be on the job during peak building operations, according to Tom C. Bell, project engineer.

The second unit, like the first, will be of the open-air type of construction. Most of the equipment will operate in the open with controls located in small buildings of steel, concrete and brick.

### Low-Cost Still Removes Light Ends From Fatty Acids

A new two-stage continuous distillation unit, designed by Foster Wheeler Corp., removes the light ends that used to discolor purified fatty acids. It's especially suited for unstable stocks. And its cost is low, because of its compact construction.

The stages are separated by a vertical wall, open at the bottom to allow passage of liquid.

Crude fatty acids are fed to the first stage in which the feed is preheated and dehydrated. Dehydration prevents fouling of the heat-transfer surfaces by dissolved salts introduced with residual water of hydrolysis.

Through distillation in this first zone—operated under high vacuum but lower temperature than the second stage—the light ends are removed overhead, together with the outgoing stripping steam. This separates them from the bulk of the fatty acids.

Dehydrated stabilized fatty acids are distilled in the second compartment. Most entrainment is removed in an internal separator, and the remainder is caught in a mist eliminator that operates most efficiently when handling a vapor containing only a small percent of liquid. High overall collection efficiency, impractical in a single stage, is the result.

Pressure drop is minimized by oversized vapor passages. This, together with stripping steam and high vacuum, insures a very low distillation temperature, and there are no hydrostatic heads to overcome. Continuous operation and small holdups also tend to make this still more satisfactory than others for handling heat-sensitive unstable feed stocks. What's more, (Continued)

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NEWS, cont. . .

since heat is applied by condensing Dowtherm, the product quality is less likely to be affected.

Delivered and erected, this still is approximately 25 percent cheaper than previous Foster Wheeler fatty acid stills. Its compactness reduces equipment and erection charges. All piping is eliminated between the two stages, and none is needed between the first section and its condenser.

### Quaker Oats Building Plant In Omaha to Make Furfural

Quaker Oats Co. presently has under construction a new chemical plant in Omaha, Neb. The plant will produce furfural, a compound that Quaker has been producing since 1922.

The Omaha operation will consist of two buildings on a five-acre site. The new plant should be completed and in production by the end of 1951. The operation will employ about 100 people.

Here's how the furfural manufacturing process works: The raw material is first ground and cooked with dilute sulphuric acid and steam under pressure in large rotary digesters. The vapors are removed, condensed and then travel through complex refining equipment to produce furfural having a purity of 99.5 percent or better. In the first step, the pentosans, which occur naturally in the raw materials, are broken down to pentose sugars such as xylose. Dehydration of the pentose sugar produces the furfural.

Quaker has two other plants producing furfural, one at Cedar Rapids, Iowa, and the other at Memphis, Tenn. The Memphis plant, which was purchased in 1946 for about \$1.5 million, is devoted entirely to the production of furfural. The new plant at Omaha will be similar to the Memphis plant.

### Detergent Licks Smog at Asphalt Treating Plant

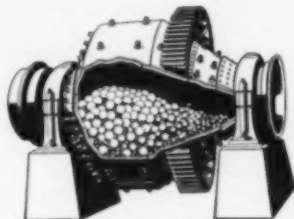
Asphalt treating plants are usually surrounded by unhappy smog-choked neighbors. The Trumbull Asphalt Co.'s San Leandro, Calif., plant was no exception until William Miller, general superintendent, cleaned up the nuisance and in the bargain found a gold mine at the bottom of the smoke stack which more than paid for his efforts.

Five years ago, Miller's plant was located miles from the nearest neighbor and no one seemed to care how much smoke came out of his stack. Today

(Continued)

## HARDINGE

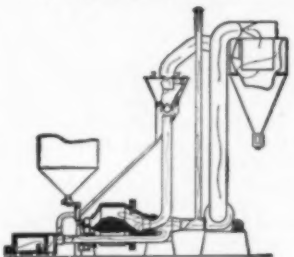
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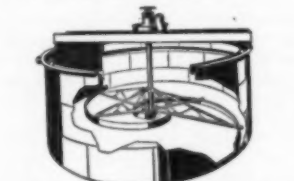
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**ROTARY DRYERS, KILNS, COOLERS**  
Write for Bulletin 16-D-11.



**AIR CLASSIFYING SYSTEMS.**  
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**THICKENERS OR CLARIFIERS**  
Write for Bulletin 31-D-11

**WET CLASSIFIERS**  
Write for Bulletin 39-B-11

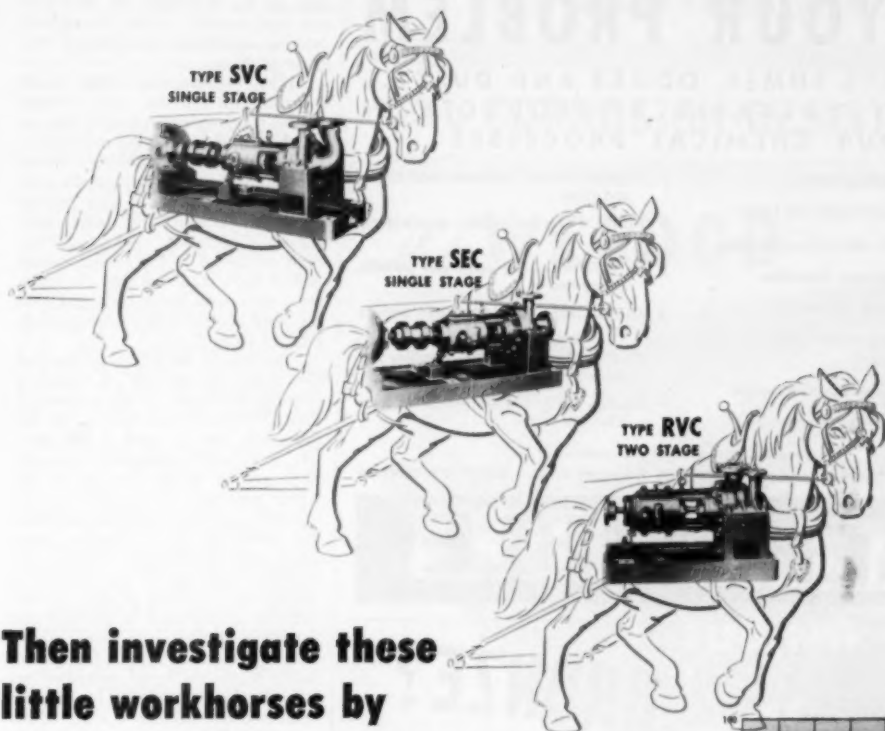


**CONSTANT-WEIGHT FEEDERS.**  
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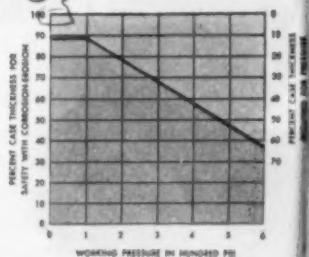
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NEWS, cont. . .

the phenomenal growth of San Francisco Bay Area industry has put neighbors on his doorstep, and smoke of the type usually emitted by asphalt-treating operations is a critical nuisance problem.

Miller experimented with several smog control systems. All of them proved relatively unsuccessful; the one which seemed to hold the most promise involved the "scrubbing" of exhaust fumes by filtering them through an aqueous solution. This system was fairly effective but after brief periods of operation, light gas oil fractions contained in the smoke formed such a tight emulsion that the filtering system soon became clogged, and the plant had to be shut down periodically to clean it out.

Chemists of the Oronite Chemical Co. suggested the use of Oronite's versatile Detergent D-40, a product derived from Oronite Alkane, the hydrocarbon base for most of the popular household detergent products. D-40 proved to be the key to the whole problem. Its presence in the aqueous scrubbing solution prevented the formation of oil-in-water emulsions, allowed the gas oil to be recovered, and reduced exhaust smoke 90 percent. A system of spray jets was installed in the stack to facilitate the scrubbing process. "Clean" oil-free water is recycled through the system. Some of the recovered water-free gas oil is used in Trumbull's heating system, and the balance is sold. Miller estimates that the value of the oil recovered in the first three months of operation paid for his installation costs. His fuel purchases, which previously had amounted to about 25,000 gal. per month, have been cut by 75 percent. Other Trumbull plants are being converted to this system as rapidly as possible.

Miller is currently working on other applications of the scrubbing principle utilizing D-40, and has developed some rather startling methods of making smoke "pay." He believes that many of the smog problems currently troubling industry can be overcome by the application of this principle and invites inquiries directed to him at his San Leandro address.

### Kraft Pulp Mill in Dixie Will Have 200 Ton Capacity

Riegel-Carolina Corp., subsidiary of Riegel Paper Corp., will construct a \$13 million bleached kraft pulp mill at Acme, N. C., about 20 miles west of Wilmington. The mill will have a capacity of 200 tons a day.

The new mill will be located on the

Cape Fear River adjacent to the 150,000-acre Waccamaw Forest. J. E. Sirrine Co., Greenville, S. C., is engineer, and C. M. Guest & Sons, Anderson, S. C., has the construction contract.

Financing has been approved by stockholders and the mill is scheduled for completion in January 1952.

### Geiger Counter Controls Catalyst Flow in Cracker

Salt Lake Refining Co., a subsidiary of Standard Oil Co. of California, has its \$4 million catalytic cracking unit on stream. Operation is fully automatic, including the use of a vacuum flasher.

Its completion marks the virtual end of a \$20 million expansion at the Salt Lake refinery carried out over a 3-yr. period. A 13-acre "lake" containing upwards of 1 million barrels of crude was on hand as stock for the new cracker.

Radioactive materials and Geiger counters are utilized on the 239-ft. high catalytic cracking unit. Radium chloride points are set at various levels in the giant bin containing aluminum silicate catalytic agent. As the bin empties and fills, a Geiger counter notes the level of the catalyst in the vat and records the quantity on control house dials. The new Houdriflow cracker also features a device whereby 5 lb. of air per unit of operation lifts some 300 tons of aluminum silicate beads to the top of the unit.

### Rubber Cutbacks Spell Boom To Utah Gilsonite Miners

Curtailment of civilian use of natural rubber is having the curious effect of booming one Utah mining operation, the production of gilsonite. This microcrystalline hydrocarbon, mined in the region of Bonanza and Eureka in Uintah County, is widely used in the manufacture of asphalt-based floor coverings and as a substitute for rubber in the manufacture of battery cases. It is likewise utilized in paints and lacquers, and is being introduced in sizable quantity into the crude oil pipeline of the Salt Lake Refinery Co., a Standard Oil Co. of California subsidiary.

The American Gilsonite Co., a Standard of California subsidiary, controls over three-fourths of the Utah gilsonite production, and, since the hydrocarbon has not been found elsewhere in the United States—three-quarters of the national output as well.

In the past two years, open pit mining methods have been adopted to  
(Continued)

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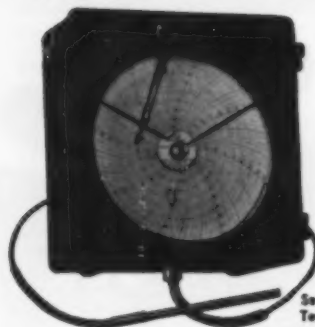
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News, cont. . .

work the gilsonite veins near both Eureka and Bonanza, with production reported at somewhat over 62,000 tons annually. The change-over from underground mining methods has greatly reduced production costs, but the gilsonite operations still suffer in competition with asphalt products from refineries due to freighting difficulties. Operators estimate that the freight rate on gilsonite shipped east from Utah equals the value of the material itself.

However, it is believed the rubber controls and reductions in asphalt production may change the picture, giving a healthier market for mine tonnage. The material may likewise find another war-born use, since gilsonite reportedly makes an excellent coking material for the production of electrodes used in the aluminum industry.

Synthetic detergents will be manufactured in new facilities at the Port Arthur, Tex., and Philadelphia, Pa., plants of Atlantic Refining Co. Atlantic Refining plans to spend between \$3 million and \$4 million for this expansion.

Battery of coke ovens will be constructed by Koppers Co., Inc., for the Geneva Steel Co. at its Ironton plant near Provo, Utah. The new battery of 23 Koppers-Becker ovens, gun flue type, will have a carbonizing capacity of 600 net tons of coal per day.

### READERS' VIEWS

#### AND COMMENTS

To the Editor:

Sir:—In the January issue of your publication there was an article describing the method of refining salt used by the Morton Salt Co. at Grand Saline, Tex. In it credit is given indirectly to the H. K. Ferguson Co. for having constructed the plant.

This is not correct. Ferguson was engaged by Morton to move the existing plant facilities to a new site.

The vacuum pans shown in the article were built by Manistee Iron Works Co. of Manistee, Mich. This firm has built most of the vacuum pans used in the various Morton Salt plants. We have been constructing complete salt plants in various parts of the world for a long time. In fact, the flow charts are the same that have been used by our company for years.

L. J. DERANJA

Manistee Iron Works Co.  
New York





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**ALWAYS** open

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You are always welcome here—in our Customer Engineering Service—where we discuss problems that deal with tubing and its various functions.

There's no point in your struggling with a condenser tube problem when you can have the answer so readily here in Customer Engineering Service.

The vast experience of more than three decades of extensive tube-making is represented within this department. And it's all available for you to draw on without cost.

The time to think about the specifications of your condenser tube requirements is *before* you retube—before you encounter difficulties—so you can be sure that your condenser will function at top efficiency.

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Installed cost.....	\$64,000
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Space occupied (sq. ft.).....	750
Drying cost per 100 lb.....	\$1.442

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Installed cost.....	\$86,400
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Drying cost per 100 lb.....	\$3.533

**NEW INSTALLATION**

**PAYS FOR ITSELF IN 491**

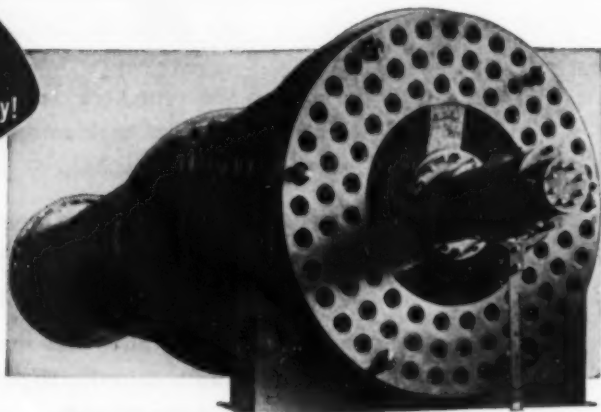
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**OPERATION**

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Turbo-Mixers, Evaporators, Thickeners,  
Dewaterers, Towers, Tanks,  
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Compare the facts and figures shown at the left. More persuasively than anything else that could be said, they tell you why this chemical company decided on a new Louisville Dryer. It was especially designed for this manufacturer after a Louisville engineer surveyed his drying processes. Savings—added production and extra protection from contamination were forecast by tests of the new equipment in our unique research laboratories and pilot plant—proof that it pays to know the results before you buy!

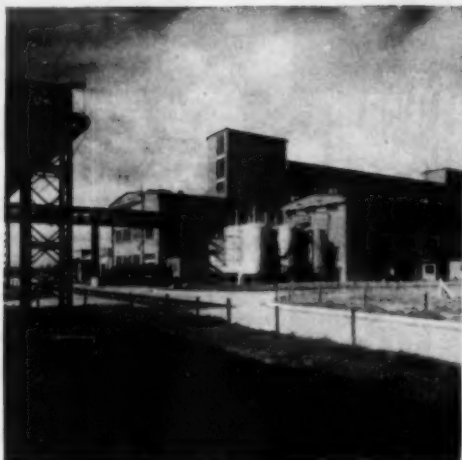
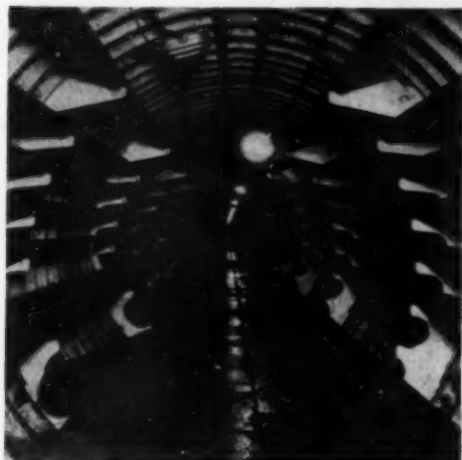
It costs you nothing to have a Louisville engineer survey your drying methods. Write today.

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Subway-like tunnel under River Tees carries pipelines linking Billingham plants with new ones at Wilton, eg. resin-powder unit above.

## ICI Develops First Stage of Huge Expansion

**New plants, underwater pipeline tunnel, power and transport services: 40 percent completed.**

Biggest single chemical-plant construction project in British history is underway at Wilton, North Yorkshire. Imperial Chemical Industries has been at work for three years on plants and facilities that will be the bases for expansion of any of its eleven manufacturing divisions for years to come. Not only additional plants for ICI products already well established, but those for the products just recently developed and for future products will be accommodated. Estimated cost of the completed project is \$72.2 million. The 2,000-acre site is just across the River Tees from the firm's huge Billingham plant.

### PLANTS

The first two Wilton plants, producing Perspex acrylic sheet and phenolic molding powders, have begun operations. Soon urea molding powders and polythene will be produced. Under construction is a plant to turn out the new fiber-forming polyester known as Terylene in England, Fiber V in the U.S.

Raw materials for polythene and

Terylene will come from an oil-cracking plant whose large tanks and towering steel structure are already features of the Wilton landscape. Crude will be delivered by ocean-going tankers at new berths under construction at Teesport. Hundreds of tons a day will be cracked to obtain simple hydrocarbons such as ethylene, propylene, methane-hydrogen and butane. For the present, the two most important of these gases are ethylene and propylene. From ethylene Wilton will make not only polythene but detergents and antifreeze. From propylene will come acetone, some of which will go into the manufacture of Perspex.

### LINK TUNNEL

Production of acetone will be carried out at Billingham. Wilton's propylene will be sent there by pipeline along a route nearly 10 mi. in length which will pass under the River Tees through a tunnel 1,750 ft. long. This tunnel, already completed, is built like London's Underground with the same 9-ft. diameter. Other hydrocarbon gases and byproduct gasoline produced in the oil-cracking plant will also travel through the tunnel to Billingham. In the reverse direction will flow brine from the South Durham field for the electrolytic plant producing chlorine and caustic soda. Bulk of the

hydrogen gas formed as a chlorine by-product will go through the link to Billingham. Some will be retained at Wilton for use in the production, by an improved process, of alpha naphthylamine for the dyestuffs industry.

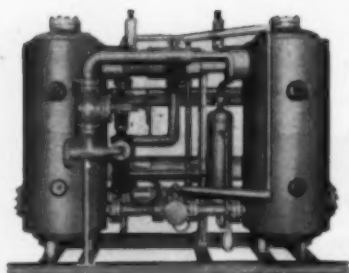
### POWER

All processes at Wilton are carried out at fairly high temperatures and some at very high pressures. When the present stage of development is completed, it is expected that about 500 tons of coal will be used each day in the boiler house. Steam will be raised at a pressure of 900 psi. Before being sent out into the network of pipes feeding the plants, this steam will be passed through turbo-alternators which will generate the bulk of the 30,000 kw. required for production.

For cooling purposes, arrangements have been made by the Tees Valley Water Board to supply 42 million gallons a week of water. Drawn from the River Tees at Low Worsall, it will be piped to Wilton Works' 6-million-gallon reservoir through 13 mi. of main.

### TRANSPORT

An extensive road and rail system is being constructed including over 10  
(Continued)



## Install the New Pritchard HYDRYER\* . . .

... for Dependable Dehydration  
of Air and other Gases

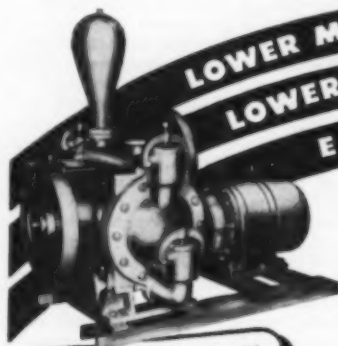
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air for instrument and process controls.  
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units designed to reduce dew points  
of compressed air and other gases to minus  
(-) 40° F. Only service connections are re-  
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units can be built to your requirements.

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# Shriver

## DIAPHRAGM PUMPS

## FOREIGN NEWS, cont. . .

mi. of roads and 15 mi. of railways.  
Some 8 mi. of these railways will lie  
in an area of over 100 acres reserved  
for the Wilton Works main sidings.  
The lines will branch off the main line  
over newly-constructed bridges into  
the works. Through these bridges will  
also pass a main drainage culvert, 7 ft.  
in diameter, which will be able to han-  
dle a flow of 90 million gallons per  
day.

## Reported This Month . . .

### INDIA

**Plant for producing uranium and tho-  
rium compounds from uranium and  
uranium-bearing residues of the monazite plant at Alwaye is almost  
completed. It will meet operating  
costs by selling thorium compounds to  
the domestic gas-mantle industry.**

Manufacture of beryllium and its  
alloys in India is under considera-  
tion and a pilot plant may be set up  
in the National Metallurgical Labo-  
ratory.

**Penicillin plant to be built by the gov-  
ernment in Bombay will begin pro-  
duction towards the end of 1952.**  
Swedish Karmbolaget firm has been  
engaged to supply technical advice.

**New drying oil made from the seed of  
the Kamala tree has just been de-  
veloped by the National Chemical  
Laboratory in Poona. Initially the  
oil will be used as a substitute for  
tung oil which has been imported  
from China. Current researches in-  
dicate that it will provide a new  
type of varnish which will leave a  
wrinkle finish when sprayed on any  
object.**

### SOUTH AFRICA

**Oil from coal plant to be built near  
Coalbrook by the South African  
Coal, Oil and Gas Corp., Ltd., will  
be the first in the Union. Hydrocol  
process will be used to produce 35  
million gallons of motor fuel a year  
initially, plus high grade diesel fuel  
and eventually industrial pipeline  
gases. Future expansions are planned  
to bring production up to 100 mil-  
lion gallons of motor fuel.**

Coalbrook, situated on the Vaal  
River not far from Vereeniging, is  
the major source of coal in South  
Africa.

**Dextran blood plasma production, re-  
cently begun by African Dextran  
Ltd., should reach a full-capacity  
rate of 20,000 l-pt. units by mid-  
year. The company, backed by**  
(Continued)

# FOR SALE!

## One (slightly used) Crystal Ball

Not a bad crystal ball... as crystal balls go... but lately it has a habit of getting cloudy when we need it most. For instance: take the case of VISQUEEN\* film.

As you probably remember, VISQUEEN film was originally developed for the specific use of the armed forces. What they wanted was a polyethylene film such as had never been seen before... strong, durable, chemically inert, flexible and all the other qualities you know so well... a film that would meet rigid specifications yet be economical to use. *They got it!* And now, like many another reserve... VISQUEEN film is being called back to active service.

And that's our problem. While our Defense requirements get bigger and bigger... our customers delivery will of course dwindle. So we searched our crystal ball. And the only thing we could find is that we will have to ask you to please be patient... we're working hard, and we'll work harder to make every effort to fill your orders. You may be cut down... but we promise we will do the best we can to get VISQUEEN film to you.

\*T.M. The Visking Corporation



### IMPORTANT!

VISQUEEN film is all polyethylene, but all polyethylene film is not VISQUEEN. VISQUEEN is the only film produced by the process covered by U. S. Patent No. 2461975. Only VISQUEEN film has the benefit of the research and extensive technical experience of The Visking Corporation, pioneers in the development of polyethylene film. Be sure. Always specify VISQUEEN film for superior tear and tensile strength and greater uniformity.

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In Canada, Visking Limited, Lindsay, Ontario

CHEMICAL ENGINEERING—March 1951



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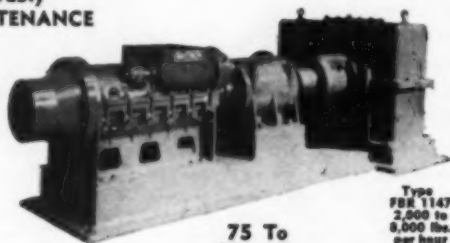
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LOW MAINTENANCE**

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2,000 To  
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**Type  
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2,000 to  
8,000 lbs.  
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to help solve problems of mixing, masticating, plasticizing, compounding. Experimental or laboratory machine available for this work.

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## FOREIGN NEWS, cont. . .

American, British and Swiss interests, will be turning out penicillin and streptomycin by the end of 1951. Other pharmaceutical products based on dextran, now coming into pilot plant production, are planned for the future.

Entire output of lithium ore mined by Jooste of Southwest Africa will now go to Foote Mineral Co., Philadelphia, as a result of a new agreement between the two companies. This will provide Foote, largest lithium producer in the U. S., with the greatly expanded source needed to meet mounting demand.

Industrial, agricultural and metallurgical chemicals are being turned out at the new plant at Lilianton, Boksburg of Industrial Chemical Products S.A., Ltd.

Conveyor machinery will be manufactured at a newly-purchased plant of Link-Belt Africa Ltd. at Springs, Transvaal. The company is a wholly-owned subsidiary of Link-Belt in Chicago.

## MEXICO

A \$1-million refinery has begun operations in Reynosa on the northeastern border. Its 5,000-bbl.-a-day output will supply the surrounding territory which has been dependent on imports from Texas for its refined oil.

It will draw its crude from nearby oil fields and will have access to an unlimited supply of natural gas, plus electricity from power plants in Reynosa.

Mexico's third new refinery in two years, it was built by Pemex, the government oil monopoly. It is considerably smaller than those in Salamanaca and Dieciocho de Marzo.

Purchase of oil properties of Gulf Oil Co. in Mexico has been effected by the government oil monopoly for \$2.4 million. The transaction involved about 100,000 acres of oil land, wells with a daily production of 1,500 bbl., 1 million barrels of crude stored in 57 tanks, two pipelines and 18 other concessions. Gulf had escaped expropriation with the other foreign oil companies during a 1938 labor dispute because it had settled the differences with its workers and was not involved.

## SCOTLAND

Modern gasoline producing equipment is being installed at the Anglo-Iranian Oil Co.'s Grangemouth

plant. Designed by M. W. Kellogg, a crude distillation unit and a phosphoric acid treating plant are about to go on stream. A 10,000 bbl. a day fluid catalytic cracking unit and gas recovery system will be completed before the end of the year.

**Sulphuric acid plant** is under construction at the Sandilands Chemical Works, Aberdeen, of Scottish Agricultural Industries, Ltd. To cost \$1.3 million, the plant will begin production in about two years at the rate of 37,000 tons of acid (in terms of 100 percent) a year.

#### NORWAY

**Liquid ammonia** is being produced at the rate of 150 tons daily at another Norsk Hydro plant. Built since the end of the war the plant is located at Glomfjord Salpeterfabrikker.

**Formaldehyde and synthetic resins** are being produced by Norske Kunstharpikser at Lillestrom, near Oslo. Capacity is around 3,000 tons of synthetic resins, 4,000 tons of formaldehyde. Phenol-formaldehyde, alkyd and urea-formaldehyde coating, adhesive, textile and paper resins are manufactured under license from Rohm & Haas, Philadelphia.

**Biggest pulp manufacturer** in the country A/S Borregaard, is planning a plant for alcohol derivatives, cellulose acetate and sulphuric acid. A digester house is under construction at Sarpsborg, with a capacity of 90,000 tons. Production of cellulose acetate will depend on addition of a new bleaching plant, costing 32 million kroner.

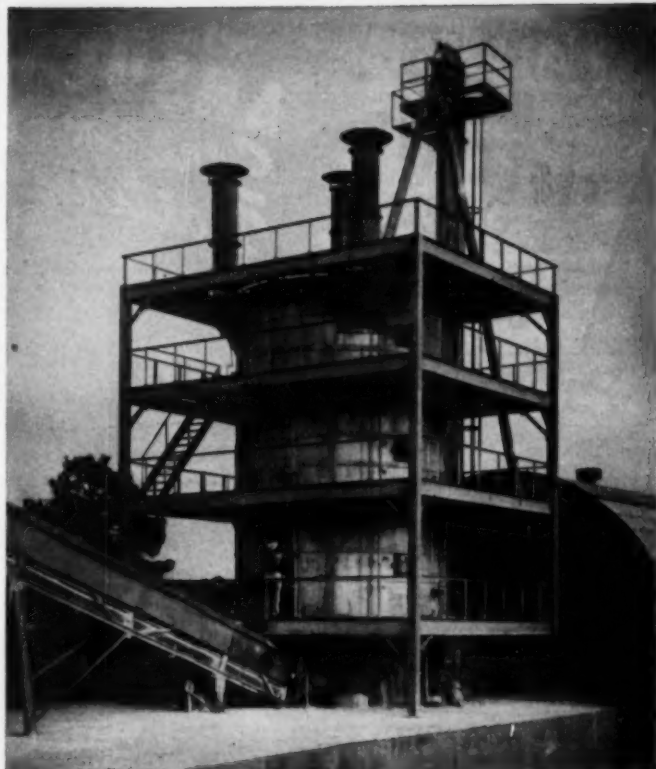
#### CANADA

**Color pigments**, including types which have not previously been available in commercial quantities in Canada, will be produced at Dominion Colour Corp.'s \$350,000 plant addition in New Toronto, Ont. Construction to begin soon will mean a 150 percent increase over present capacity.

**Huge dissolving pulp mill** of Columbia Cellulose Co. Ltd. has just started up near Prince Rupert, B. C. Initial output, 70,000 tons per year, will amount to a 20 percent boost in North American cellulose supplies.

**Petrochemical and cellulose acetate plant** near Edmonton in Alberta will be built and operated by Canadian Chemical Co., Ltd., a newly-organized affiliate of Celanese. Natural gas resources of that area will go into the making of basic

(Continued)



### World's Largest Furnace for Calcining Anhydrous Kaolin

Georgia Kaolin is being processed in NICHOLS HERRESHOFF\* MULTIPLE HEARTH FURNACES under a variety of conditions, at both moderate and high temperatures, for the production of a number of clay products of importance to many industries. Additional units for this application are under construction.

For roasting or calcining choose a NICHOLS HERRESHOFF\*—used by leading manufacturers for three generations.

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**WITH THE  
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**...plus  
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**Exclusive Features**

- Water-tight construction.
- Provides a modified cone-shaped stream pattern without hole in the center of the stream.
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- Low velocity, more effective stream of dry chemical.



**Why Advertise the Nozzle . . . .**

... because the nozzle on your ANSUL Dry Chemical Fire Extinguisher is water-tight . . . it won't become inoperative due to corrosion or caking of dry chemical within the working parts . . . the most inexperienced man in your plant can use the ANSUL extinguisher effectively . . . and only Ansul has a nozzle to meet all of these requirements!

If your hazards require special long range straight stream nozzle, you can get Ansul Extinguishers equipped with these nozzles at no extra cost. With Ansul Dry Chemical Fire Extinguishing Equipment you have not only the best fire protection but also a choice of models and designs to meet your requirements.

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ALL-WAYS!**

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**FOREIGN NEWS, cont. . .**

organic chemicals which have not previously been manufactured in Canada. It is reported that the company will use the Celanese process of direct oxidation of petroleum hydrocarbons.

**JAPAN**

Chemical fiber manufacturers have adopted a three-year plan for boosting rayon and staple fiber production up to 500 million pounds by 1953. This would make Japan's production second only to the U. S. Staple fiber would represent 334 million pounds and rayon 170 million. The plan is aimed at total exports of 135 million pounds, an increase of 130 percent over this year's estimated exports.

Construction of a polyvinyl chloride plant at Kambara, about 65 mi. from Tokyo, will begin within a few months. It will be operated by Japanese Geon Co., Ltd., newly formed by B. F. Goodrich Chemical Co. and several large Japanese industrial firms.

DDT output in 1950 was 752 tons; most of it went to Korea for the use of U. N. forces. Nippon Soda Co., largest of the country's eight manufacturers, was responsible for 201 tons. The industry's installed capacity is about double the output.

**GREAT BRITAIN**

Stearic and oleic acids are being produced at a plant at Bromborough Pool which was designed by Blaw Knox for Price's Ltd. The solvent separation process in use, originated by Emery Industries, is new to England.

Sulphuric acid statistics for 1950 published by the National Sulphuric Acid Assn. show production of sulphuric and oleum, in terms of 100 percent acid, increased to 1,802,669 tons over 1,660,267 tons in 1949. Consumption mounted from 1,677,509 tons to 1,816,134 tons. Installed capacity of the industry rose from 1,791,740 tons to 1,980,470 tons with the increase wholly in contact plants. Most of the new plants are designed to use pyrites or other materials alternative to native sulphur.

Sodium hydride tube descaling plant of Accles and Pollock in Oldbury is now turning out stainless steel tubes at full capacity. The company exports 10 percent of its output to the U. S. and 10 percent to Canada.

—End

- ① Low-temperature drying with agitation
- ② For a wide range of products
- ③ Rapidly and economically in
- ④ **BUFLOVAK Vacuum Rotary Dryers**

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Vacuum Double Drum  
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① **BUFLOVAK Vacuum Rotary Dryers** give profit-building results. They are used for drying materials requiring low temperature and agitation, and for the recovery of volatile solvents from materials or dregs after leaching or extraction processes.

② A wide range of chemical, pharmaceutical and food products, including hygroscopic materials, can be dried or processed. They include such materials as cellulose acetate and its derivatives, dregs, drugs, dyes, fine chemicals, fish scrap, intermediates, pharmaceuticals, pigments, and starch.

③ Drying time is shortened. Adjustable paddles speed-up thorough mixing. A heated center tube and paddle arms increase heat input. The revolving type rotary dryers safely handle delicate crystalline materials without injury to the grain structure.

④ **BUFLOVAK Vacuum Rotary Dryers** are built in various designs and sizes, including sanitary types, to meet every industrial requirement. Special features may include dust-tight housing for charge and discharge doors, equipped with locking devices and lifting mechanism. Built-in spray nozzles can be furnished to flush the dryer.

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Stainless Clad Agitator with center heating tube and arms being inserted in a 6' dia. x 36' long Vacuum Rotary Dryer.

**P.S.**

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To assist you in the solution of processing problems, **BUFLOVAK** offers the facilities of its Research and Testing Laboratory—where small scale experimental units show you, before you buy, the commercial possibilities, data on production cost, and characteristics of the finished product.

*Buflovak Equipment*

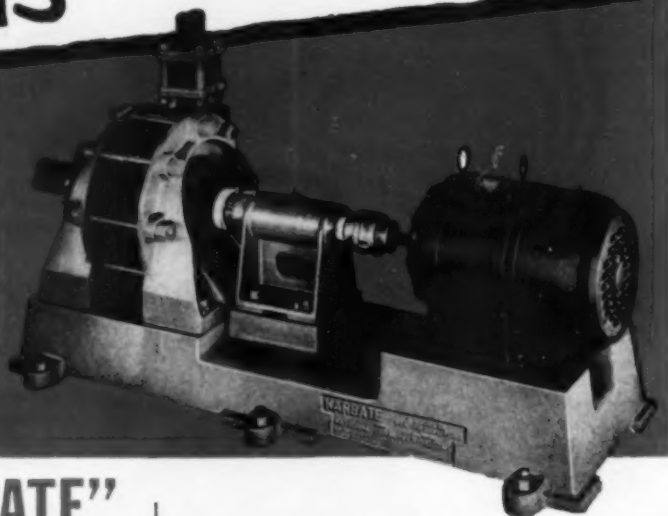
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To the savings made by the reduction in "Karbate" brand impervious graphite pump prices (up to 33%), add the all-important factor of very low annual maintenance cost. Our records show some pumps in service for years, requiring practically no replacement parts.



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**Impervious Graphite  
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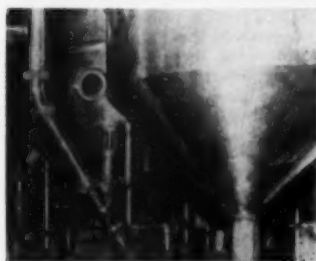


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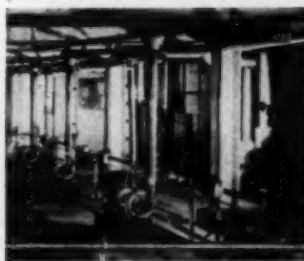
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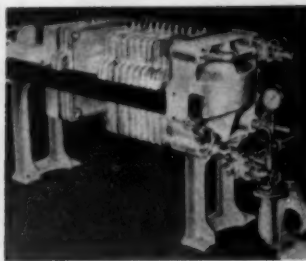




EVAPORATORS, . . .



PUMPS, . . .



and FILTER PRESSES . . .

. . . that handle citric acid solutions rate careful selection, especially when the product is for human consumption, as in food processing and pharmaceutical industries.

## Materials of Construction vs. Citric Acid

### WORTHITE

W. E. PRATT, Worthington Pump and Machinery Corp., Harrison, N.J.

Citric acid is not considered to be a highly corrosive agent in aqueous solutions to the stainless steels, but absolute freedom from contamination is of utmost importance to the pharmaceutical plants which manufacture citric acid and citrates, or other products involving citric acid. Worthite is so perfectly resistant to citric acid solutions at all strengths and temperatures that it has been used for manufacturing equipment other than pumps for citric acid use.

The food industry is another large user of Worthite, especially in pumps handling citrus juices. The introduction of frozen orange and other citrus juices has required the installation of dozens of new evaporators. Two to five pumps are required for each evaporator. Concentration increases the corrosiveness, and evaporators are made of stainless steel.

The circulating pumps must be made of a similar or a superior alloy due to the higher velocity in the pumps. The majority of the pumps in use on the various types of evaporators are Worthite. Most of these pumps are equipped with a special mechanical seal, which eliminates the possibility of contamination or bacteria growth in stuffing box packing, and provides a perfect seal against the very high vacuum required in the evaporators. These seals have re-

quired no maintenance in 3 seasons of service.

Worthite circulating pumps are used on the Majonnier low-temperature orange juice evaporator shown above. Also shown: Worthite orange juice preconcentrator circulating pumps, and a Worthite plate and frame filter press for handling a citric acid product.

### COATINGS

KENNETH TATOR, Kenneth Tator Associates, Coraopolis, Pa.

Citric acid solutions are non-oxidizing and only mildly corrosive except at high dissolved oxygen contents. Hence they represent no particular problem as far as organic coatings are concerned. All of the commonly used organic coating and lining materials may be used for citric acid solutions within their usual temperature limitations. These include all of the rubbers, natural or synthetic, hard or soft, the thermosetting phenolics and furanes, polyvinyl chloracetates, polyvinylidene chlorides, and polyethylene and its derivatives.

Selection depends upon the desired benefit, service life, and application. Where prevention of iron contamination is the principal objective, thin film coatings will be adequate providing abrasive conditions are not present. For abrasive conditions or with a high degree of aeration, linings over 20 mils should be used—and a material with sufficient resiliency to

resist excessive wear or impact may be desirable.

Wherever the citric acid product is to be used in food, beverages, or pharmaceuticals, no volatile solvent or compounding component should remain in the lining or coating to slowly diffuse into the product. Such residual volatiles may be eliminated by flushing with steam, warm water, or hot air prior to use. The flushing agent and its temperature will be determined by the known service temperature limitations of the organic barrier.

### CEMENTS

RAYMOND B. SEYMOUR, The Atlas Mineral Products Co., Mertzown, Pa.

Practically all standard commercially-available corrosion resistant cements are completely resistant to citric acid in all concentrations. Those cements that are based on thermoplastic materials are satisfactory only at temperatures up to 150 deg. F. and sulphur cements are satisfactory only at temperatures up to 200 deg. F. Silicate cements are completely satisfactory at both room temperature and elevated temperatures but are not usually considered for citric acid because of their high water absorption and the danger of crystallization of citric acid in the cement itself. Carbon-filled cements based on polymers of furfuryl alcohol or phenolic resins are completely satisfactory for all con-

(Continued)



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### CORROSION FORUM, cont. . .

centrations of citric acid up to 375 deg. F. A carbon filled resin cement based on a modified polymer of furfuryl alcohol has given excellent service as a jointing material for brick and tile floors in the citrus fruit industry.

Many of the newer corrosion resistant cements, such as those based on modified phenolics and polyesters are satisfactory for citric acid over a wide range of temperatures but those based on melamine are not adequate for this service. A general summary of resistance data is given in the table below but manufacturers should be consulted for specific recommendations.

Resistance of Cements to Aqueous Solutions of Citric Acid in All Concentrations

Cement	Temperature, Deg. F.		
	70	150	205
Asphaltic	G	P	P
Coal tar	G	P	P
Polyfurfuryl alcohol	E	P	E
Hydrocarbon polymers	VG	P	P
Melamine	F	P	P
Phenolic	E	E	E
Phenolic (modified)	E	E	E
Polyester	E	E	E
Silicate	G	G	G
Sulphur (plasticized)	E	E	P

Legend: E—Excellent; F—Fair; G—Good; P—Poor; VG—Very Good.

### WOOD

HENRY B. SMITH III, Michigan Pipe Co., Bay City, Mich.

Citric acid has some effect on the cellulose portion of wood when concentrations exceed 20 percent and operating temperature exceeds 120 deg. F. Wood pipe is not used to speak of for conveying citric acid solutions.

### GLASS-LINED STEEL

S. W. McCANN, The Pfaudler Co., Rochester, N. Y.

Glass-lined steel chemical equipment is fully resistant to citric acid solutions at all concentrations and temperatures. It has found fairly wide use in the citrus fruit industries and is used in the pharmaceutical and fine chemical field for handling citric acid and salts of citric acid. Generally standard equipment is used for jacketed evaporators and crystallizing dishes.

### LEAD

KEMPTON H. ROLL, Lead Industries Association, New York, N. Y.

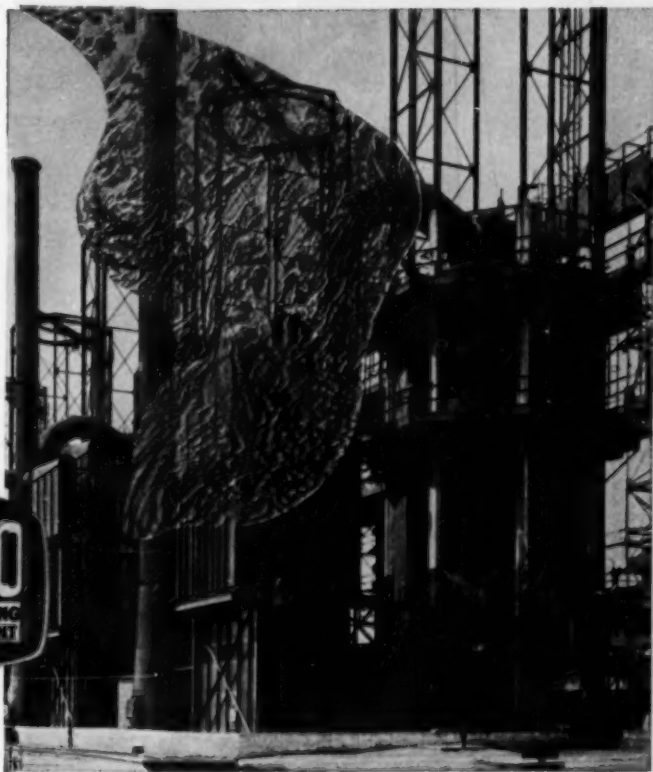
Up to 150 deg. F. lead can be used with all concentrations of citric acid. However, when the acid is to be used (Continued)

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... engineers  
"farm"  
their  
problems  
to the



forty acres



In the forty acres of plants, laboratories, and yards occupied by Duriron, the battle against corrosion never ceases. Here, special alloys are made into corrosive-handling equipment. Duriron has no other business—and with Duriron this is

big business. All forty acres of it.

This size is important to American industry. It represents the single, surest source of aid when corrosion strikes. It means more man-power, more machine-power, and a greater likelihood that your problem, grave

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CHEMICAL ENGINEERING—March 1951



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**CORROSION**  
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**THE OHIO STEEL FOUNDRY CO.**

SPRINGFIELD, OHIO - Plants at Lima and Springfield, O.

## CORROSION FORUM, cont. . .

for ultimate human consumption, the use of lead is not advised.

### RUBBER LINING

J. P. McNAMEE, U. S. Rubber Co., Providence, R. I.

Natural rubber, both soft and hard compositions, and the various types of synthetic rubber, are resistant to all concentrations of citric acid up to the saturation point. Soft rubber may be used below 140 deg. F. while hard rubber is suitable for use up to 180 deg. F., and for special compositions as high as 220 deg. F. Several of the synthetic rubbers can be used at still higher temperatures.

### PORCELAIN

W. V. LAPP, Lapp Insulator Co., LeRoy, N. Y.

Fully vitrified white chemical porcelain is unaffected by citric acid, in any concentration and under any normal operating temperatures.

Such porcelain will maintain a purity of product and provide a freedom from contamination unavailable in many materials. This is due to the absolute zero absorption factor in a fully vitrified porcelain. No liquid can possibly enter the body to later poison subsequent processing.

Y and angle pattern valves, plug cocks, specialty valves, pipe and fittings, transfer pumps and tower packings are in regular production and readily available. Special shapes can be economically produced in chemical porcelain.

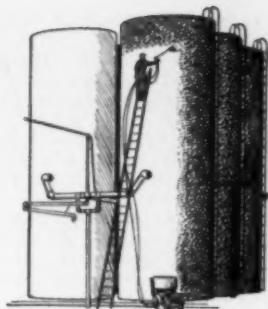
### SILICONES

J. A. McHARD and J. T. McIntyre, Dow Corning Corp., Midland, Mich.

Citric acid is most often encountered in the food industry. It is normally processed as an aqueous solution. Generally speaking silicones show good resistance to all aqueous solutions. Examples of silicones with food acids: lubricants in processing ovens, gaskets in sterilizers.

**Silicone Fluids**—A methyl polysiloxane fluid and a mixed aryl and alkyl polysiloxane derivative were exposed to 5 percent aqueous citric acid at 100 deg. C. for seven days with good results.

**Silicone Greases**—No specific data is at hand on the performance of a silicone plug valve lubricant in contact with citric acid. However, good results have been observed when such lubricants have been used in contact  
(Continued)

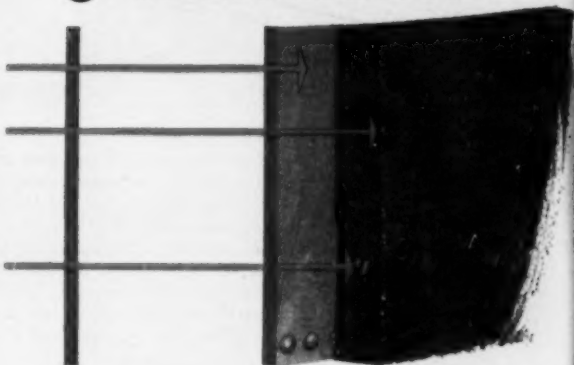


one coat of **Insul-Mastic** type "D"

*prevents*

- ✓ **corrosion**
- ✓ **heat loss**
- ✓ **condensation**

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Insul-Mastic Type D insulation requires no vaporseal or further protection. It will not absorb moisture and thus will retain full insulating efficiency throughout its life. As an insulation, it has a K factor of .36 which is approximate to that of cork board. Insul-Mastic Type D is spray applied and will adhere at any angle without mechanical support. Type D can be used on surfaces having a temperature range from minus 40° F., to plus 300° F., without deterioration.

Insul-Mastic Type D has been used to prevent heat loss on oil storage tanks, paper pulp digesters, liquid sugar tanks, warm air ducts, prefabricated metal buildings and many other types of equipment, piping, etc. It controls condensation on cold water intake pipes for boilers, in railroad freight cars, on building panels, corrugated metal roofs, and cold air ducts, etc.

Write for our booklet, "INSUL-MASTIC TYPE D INSULATION" and for the name of your nearest Insul-Mastic representative.

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The plant that manufactured the soda ash in these bags is protected with Prufcoat, as are dozens of other alkali manufacturing plants throughout the country. (Names of these plants on request).



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Yes, in plants which actually manufacture soda ash — the alkaline agent that washes off most conventional paints — as well as in plants producing mineral acids, organic acids and other alkalies, Prufcoat Protective Coatings have been providing positive protection against costly corrosion for over ten years now . . . on concrete floors, walls, ceilings, structural steel, pipes, tanks, ducts, machinery and equipment. Performance records in these chemical manufacturing plants, and in the process industries using their highly corrosive products, prove that where acids or alkalies destroy, Prufcoat Protects.

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at Lower Cost Than Any Other Air-drying Paint*

Economical in original cost as well as in the preventive maintenance terms of positive protection against costly corrosion, Prufcoat Protective Coatings come ready-to-use in single, five and 55 gallon containers and are available in a wide range of attractive colors including green, buff, black, red, white, and several shades of gray.

An experienced Prufcoat corrosion engineer will gladly make a Preventive Maintenance Survey of your plant. No obligation, of course. Write today, describing YOUR corrosion problems.



### New Prufcoat Metal-Reactive Primer P-10

... Does not require as complete surface cleaning as most other priming methods and works well on damp or dry surfaces. Makes possible a simple yet positive two-step system for corrosion-proofing old or moist metal surfaces . . . Write today for Prufcoat Technical Bulletin 012.

**PRUFLOAT LABORATORIES, INC.**

30 East 42nd Street, New York City

## Preventive Maintenance PAYS

## CORROSION FORUM, cont. . .

with other food acids. The physiological and chemical inertness of these materials recommend them for such uses.

**Silicone Elastomers**—Laboratory tests on the resistance of silicone rubber to aqueous citric acid at 100 deg. C. reveal no changes in weight or volume. Hardness is practically unaffected. Elasticity is altered slightly but not enough to affect performance. Gaskets have been used successfully on hot processing ovens.

**Silicone Resins**—None of the resins showed any weight change in contact with 5 percent aqueous citric acid at 100 deg. C. There was some change, however, in the appearance of test specimens. The originally clear pieces became opaque after 7 days exposure. Pigmented coatings formulated with two resins and applied to aluminum test panels showed good film continuity after 7 days exposure to 57 percent citric acid.

## TANTALUM

LEONARD R. SCRIBNER, Fansteel Metallurgical Corp., N. Chicago, Ill.

Tantalum is completely inert at all concentrations and temperatures. For technical grades of citric acid, there are plenty of corrosion-resisting materials of lower cost than tantalum which appear to be satisfactory. For food grades, or concentrated citrus juices where a metallic taste is objectionable, the use of tantalum heaters would be desirable.

## IRON & STEEL

ALBERT W. SPITZ, Reiter Engineering Co., Philadelphia, Pa.

Cast iron and carbon steel are not recommended for use in citric acid solutions.

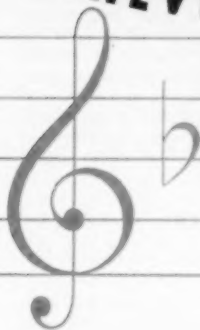
## DURIMET 20

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

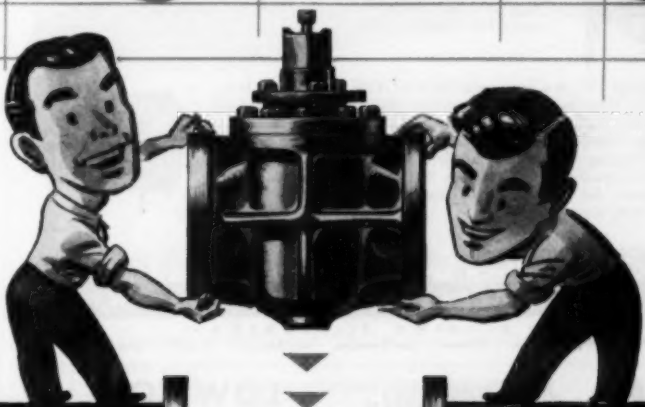
Stainless alloys have good corrosion resistance to citric acid solutions and are used to a great extent in handling this corrosive. At the higher concentrations and temperatures, these solutions become excessively corrosive to many of the stainless steels, and Durimet 20 and 18-8-S-Mo are the only ones which continue to show very high resistance. There is very little superiority of the Durimet 20 alloy for most solutions, but it is often better than the 18-8-S-Mo alloy for the concentrated acid. Durimet 20 pumps

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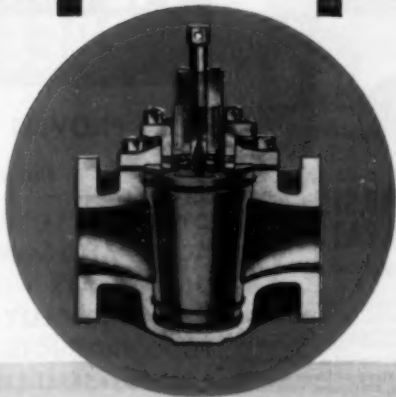
# TUNE UP YOUR CHEMICAL LINES FOR INEVITABLE PRODUCTION DEMANDS



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for replacements of old types.



The Big Bulge is on its way—when your chemical facilities will be taxed to capacity and you'll be wanting Nordstrom lubricated valves to insure unfailing valve service. Don't wait until leaks warn you of needed replacements of old and obsolete valves. Now's the time to re-appraise your valve situation. Replace with Nordstroms—the valves with tapered plug and protected seat—ever easy to turn, corrosion-resistant, erosion-resistant and most dependable for chemical services.



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Take our word for it, there's a  
Stainless Steel SAN-I-TANK — standard or  
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are two standard tanks, for example, that show what we mean:



Type "CJ" is an open top, jacketed, stainless steel tank that can be used for every kind of hot or cold processing. Jacket is warranted to 150 p.s.i. working pressure. Tank can be equipped with side, bottom or top-entering agitators and all types of fittings and connections. Capacities: 60 to 1000 gallons. Write today for Bulletin JS-50.

Type "H" is a horizontal SAN-I-TANK designed to handle large quantities of liquids in minimum overhead space. This is a stainless steel, single-shell. For mixing, blending or storage purposes, it may be equipped with top or end-entering agitator and any type of connections. Available in capacities ranging from 200 to 4500 gallons. Write today for Bulletin SS-50, describing this and other single shell tanks in detail.



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- 1—Maximum filtering area per dollar of initial cost.
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ACIDS AND ALKALIES  
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Manufacturers of Stainless Steel Tanks for Storage and Mixing. All sizes. All shapes.

### CORROSION FORUM, cont. . .

are frequently used as an added factor of safety.

Durimet 20 should prove to be a valuable alloy for handling citric acid in combination with sulphuric acid. Although not a good hydrochloric acid alloy, Durimet 20 is fairly resistant to dilute solutions at ambient temperatures. With substantial quantities of HCl present in a citric acid solution, or at elevated temperatures, the high-silicon iron, Durichlor, or one of the Chlorimet alloys should be used.

### CHLORIMETS

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

Chlorimet 2 and Chlorimet 3 are satisfactorily resistant to citric acid solutions at all concentrations and temperatures up to boiling. However, their use in handling the pure acid is very limited because of the good resistance shown by less-expensive alloys.

Other contaminants, such as hydrochloric acid, would certainly label the Chlorimets as economical alloys—especially with high temperatures and concentrations.

### HIGH-SILICON IRONS

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

The high-silicon iron alloys, Duriron and Durichlor, provide very good resistance to all citric acid solutions. Corrosion rates are very low even at the boiling. This same high resistance can be expected when handling citric acid in combination with the various mineral acids which may be used in its production. Durichlor is the more suitable alloy when hydrochloric acid is encountered.

### ALUMINUM

A. B. McKee, A. Fitz, and D. J. Fetchko, Aluminum Co. of America, New Kensington, Pa.

The excellent corrosion resistance of aluminum and its non-toxic properties make it ideal for production of citric acid by the fermentation of sugar.

The process involves storage of inoculated sugar solutions in shallow aluminum pans at 77-95 deg. F. for about 10 days. The non-toxic nature of the aluminum pans is largely responsible for the high yields obtained.

Corrosion rates in citric acid solutions are low at all concentrations even at 122 deg. F. At 212 deg. F, how-

ever, relatively high rates of corrosion occur. Maximum corrosion occurs at dilute concentrations in the range of 0.005 to 0.05 percent. The corrosion is uniform.

## STAINLESS STEEL

GRANT L. SNAIR, JR., Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Stainless steels are generally well suited for most equipment handling citric acid as used in the food processing, beverage, pharmaceutical, and related industries. Like most organic acids, citric acid is not strongly corrosive. All of the stainless steel grades offer excellent resistance to corrosion by dilute solutions of pure citric acid up to 150 deg. F. However, when concentrated solutions at or near the boiling temperature are involved, it is advisable to use Type 316.

Types 302 and 304 are widely used for tanks, vessels, kettles, and other equipment for processing fruits, vegetables, and their juices containing citric acid at all temperatures to and including boiling.

## NICKEL & NICKEL ALLOYS

W. Z. FRIEND, International Nickel Co., New York, N. Y.

Monel, nickel and Inconel are successfully resistant to unacrated citric acid solutions of all concentrations at temperatures up to and including boiling. Corrosion rates of Monel and nickel are increased by a high degree of aeration especially at elevated temperatures. Monel generally is more resistant to boiling concentrated solutions than the other two materials. Ni-Resist has useful resistance to dilute unacrated solutions at moderate temperatures. Monel is used for the lining of large chambers for spray drying of concentrated citric acid. There are numerous applications of Monel, nickel and Inconel in the handling of citrus fruit juices. Inconel has the maximum corrosion resistance under highly aerated conditions.

## CARBON

J. F. REVILLOCK, National Carbon Division, Cleveland, Ohio

Carbon, graphite, and impervious carbon and graphite are completely corrosion resistant to all concentrations of citric acid to the boiling points. These materials are found most useful where the corrosive conditions are more severe due to the addition of a mineral acid or other corrosive contaminants. For these services, structural carbon and graph-

(Continued)

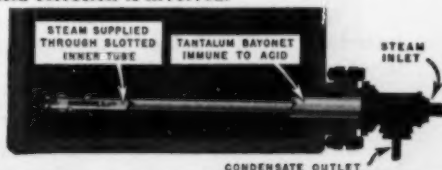
# a \$4,000,000 Process...



dependent on a  
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Any number of elaborate and expensive processes can be cited where the success of the process depends upon the continuity of performance of a single heat exchanger unit. If the unit is shut down, the process is shut down. That is why Tantalum Heaters are so important where acid corrosion is involved.

Installation of Fansteel Tantalum Bayonet Heaters is made through side or bottom openings in vessels. With the heater entirely submerged, the total area of the tantalum bayonet is an active heating surface.



## FANSTEEL ACID-PROOF TANTALUM BAYONET HEATERS

USE TANTALUM WITH ECONOMY for most acid solutions, corrosive gases or vapors; not with HF, alkalis or substances containing free SO<sub>2</sub>.

Write for informative booklet on Tantalum Acid-Proof Chemical Plant Equipment.

Tantalum combines the physical properties of steel with the chemical properties of glass... the results, speed in heat transfer, acid-proof—for most acid solutions and corrosive gases or vapors, and freedom from thermal shock. Fansteel Tantalum Heaters heat faster—save time, fuel and space—have a long life expectancy—give freedom from product contamination due to corroded equipment.

For consultation on any corrosion or heat transfer problem where Tantalum can be economically used to your advantage, consult Fansteel engineers... they are at your service. Fansteel Metallurgical Corporation, North Chicago, Illinois, U. S. A.



# Fansteel

13403-C

Acid-Proof  
**TANTALUM**  
CHEMICAL PLANT EQUIPMENT



"LOOK MOM,  
NO TEETH!"



"... The gages specified on the above order are to replace standard clock gear movement type now in use to indicate pressures in several of our chemical processes which are subject to considerable pulsation. From previous experience the writer has found the Helicoid movement to be far superior to the old type."

Signed by a Plant Superintendent.  
Name of company on request.

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Of course they have to be dependably accurate—long-lasting—easy to calibrate. Those are the advantages that add up to lower cost per gage, per year. And the more gages you use, the more substantial the saving.

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## CORROSION FORUM, cont. . .

ite can be fabricated into linings for tanks, towers, and reaction vessels, grill supports for packed towers, and tower packing. Many standard forms such as tubes, brick, plates, and beams are available in both materials. The high heat transfer characteristics of impervious graphite makes it well suited for heat transfer equipment. Pumps and a complete line of pipe, pipe fittings, and valves made of impervious graphite are available for process piping handling citric acid solutions.

## STONEWARE

F. E. HERSTEIN, Glascote Products Inc. (Until recently with General Ceramics and Steatite Corp., Keashey, N. J.)

Chemical stoneware is completely inert at the temperatures and pressures commonly encountered. It is used in pipes, pumps and vessels where purity and non-contamination are required. However, its use is limited to those applications where there are other materials present, such as hydrochloric or other acids, which would attack metallic materials of construction.

Chemical stoneware, although completely resistant, is used mainly where more economical materials of construction such as the metallics are not suitable.

## Chromic Acid

NOTE: The following two articles conclude the series on chromic acid started in the February issue.—EDITOR.

## PORCELAIN

W. V. LAPP, Lapp Insulator Co., LeRoy, N. Y.

Since chromic acid can usually be handled by other construction materials less costly and somewhat easier to fabricate and handle, porcelain does not often get first call on such service.

Corrosion rate may vary considerably if chromic acid shows certain impurities or temperatures must be increased. Where specified materials are going out, chemical porcelain, with its far broader resistance to attack, is well warranted.

Vitrified white chemical porcelain is one of the few materials that will handle the wide range of chemical conditions that may, knowingly or un-

(Continued)



*Name the toughest valve job in your plant*

*Is it*

CHLORINE?  
CAUSTIC?

HYDROFLUORIC ACID?  
AVIATION GASOLINE?

SULFURIC ACID?

AMMONIA?

LPG?

ETHYLENE  
OXIDE?

THE  
**Cameron**  
NON-LUBRICATED  
LIFT-PLUG VALVE

IS SPECIFICALLY DESIGNED FOR  
THESE AND OTHER DIFFICULT SERVICES

Test this great new valve in your most difficult service. See for yourself how easily it operates and how tightly it seals, yet it requires no lubrication. No periodic maintenance. No danger of product contamination or clogging of metering equipment. No lubrication expense. It combines the best features of gate and plug valves with new Cameron innovations:

1. **NON-LUBRICATED** — no grease of any kind required to effect a seal; prevents contamination of line products; reduces chance for human error and expense of lubricant maintenance.
2. **PRESSURE SEALING** — when plug is seated, line pressure automatically forces seat into tighter engagement with plug — body distortions do not affect the seal.
3. **UNIQUE LIFT-PLUG ACTUATOR** — a novel mechanical design which lifts, turns and reseats plug in continuous turn of a lever.
4. **RENEWABLE SEAT AND PLUG** — easily replaced; permits any desired trim for specific services.
5. **REPAIRS ON THE JOB** — can be completely overhauled without removal from line; no special tools or skill required.
6. **EASY OPERATION** — requires less operating effort than other valve designs.
7. **FORGED STEEL** — all parts, including body for most sizes, are press or drop forged from specification materials.

Your inquiries are invited. Complete details will be gladly sent on request.



1 **LIFT-PLUG ACTUATOR** lifts, turns and reseats plug in only three-quarters of a turn of the operating wrench.

2 **SEPARATE, RENEWABLE SEAT:** Pressure-created body deflections and line strains cannot destroy the geometry of the fit between sealing surfaces because they cannot be transmitted to the separate seat.

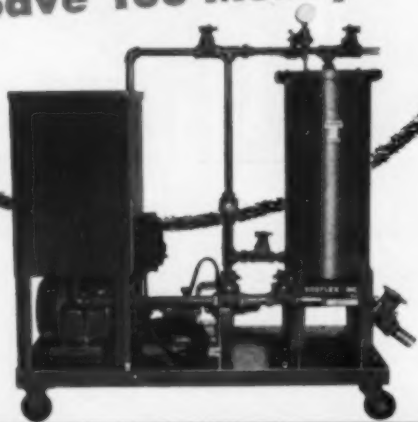
**Cameron**  
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### CORROSION FORUM, CONT. . .

knowingly, be encountered in handling chromic acid.

### HASTELLOY

EDWARD D. WEISERT, Haynes Stellite Division, Kokomo, Ind.

The use of the Hastelloy alloys with chromic acid has been rather limited for economic reasons. Hastelloy alloys B and D are not resistant to chromic acid but Hastelloy alloy C has quite good resistance to chromic acid.

Hastelloy alloy C has been used to a limited extent in pumps and valves for handling chrome plating baths consisting of a mixture of chromic acid and sulphuric acid. There has also been limited use of the material in the tanning industry in circulating and handling hot chromic acid. While no specific field test data are available, the laboratory tests of Hastelloy alloy C in a standard chrome plating solution at temperatures of 160 deg. F. show an average corrosion rate of approximately 1/16 ipy. Tests conducted at the boiling point in the same solution showed approximately twice the penetration rate as those tests conducted at 160 deg. F.

—End

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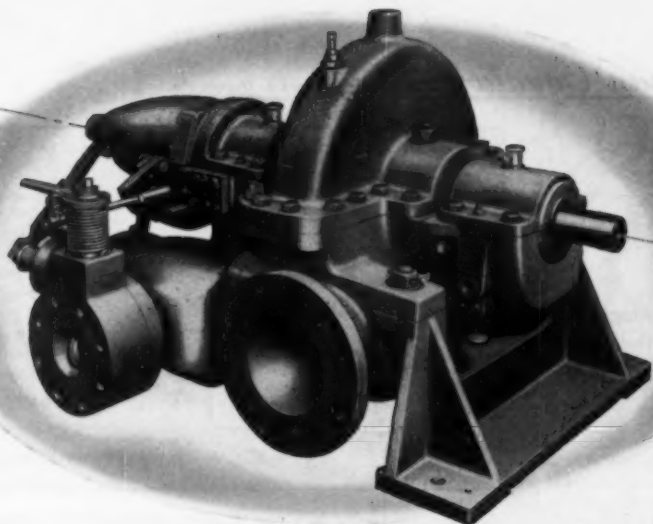
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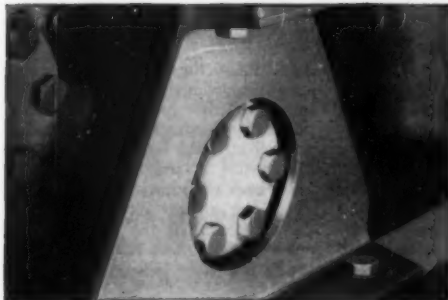
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**TYPE E** Turbines

## Security vs. Venture

A phase diagram can be used to plot the areas of safety and risk in the quest for opportunity.

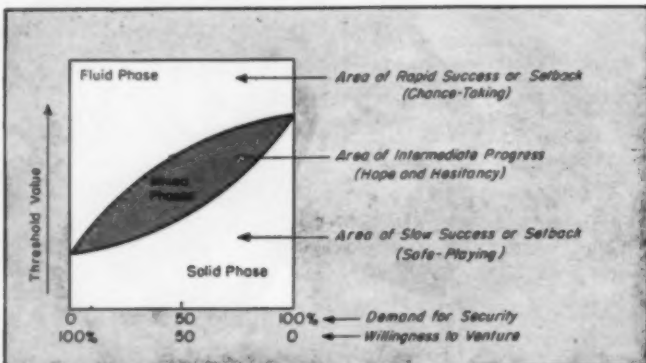
The question of whether to "play it safe" or "take a chance" has been and always will be the dilemma of any mortal who undertakes the making of a decision. It's a dilemma that is especially onerous because it can't be easily shared. And trite advice from well meaning colleagues is seldom helpful since it usually falls into the two extremes of "nothing ventured, nothing gained" and "better safe than sorry."

Ultimately, the decision for action must take form in the mind of the poor perplexed wretch himself who has to live with or by the results of his particular choice. And if the decision is wrongly made, especially if it affects the fortunes of others, his critics will be many.

But all of this isn't news to the social scientists. Psychologists, for instance, have long listed a desire for security, a desire for change and a desire for recognition as the three big drives in life. Indeed living would be a lot simpler if it were possible to satisfy all these desires simultaneously. But difficulty arises because recognition usually comes as the result of success (the making of correct decisions) which in turn follows a knock-down drag-out fight between an appetite for venture and a thirst for security.

The problem becomes all the more complicated because the security-venture dilemma cannot always be resolved on the basis of dollar values. Quite often the question is that of choosing between a comfortable, safe accepted mode of action or thinking and a tempting, untried but novel idea or approach.

There have been some noble, and in a few cases promising, tests developed by psychologists to determine whether a subject has a general tendency toward either a venturesome or a security-minded attitude to life.



But the big trouble with any attempt to classify people on this score is that an individual may use any number of different ratios of demand-for-security/willingness-to-venture in making his daily decisions. The man who would risk a bankroll on the throw of the dice might hesitate to try a new brand of toothpaste.

Of course it can be argued that man is a rational creature who bases his decisions on the best factual data available; that he calculates the odds for success and proceeds accordingly. But the record doesn't seem to bear this out. Sooner or later the subjective experience of the individual prompts the final "objective" decision.

### THE PHASE DIAGRAM

One possible way of looking at the whole security-venture situation is by means of the familiar two-component, two-phase diagram of physical chemistry. The "Human Equation" presents it (with sociological interpretations) at the top of this page and with apologies to physical chemists and chemical engineers everywhere.

It depicts an equilibrium between two phases or two areas of action on a problem or situation. The solid phase (safe-playing) is the area wherein movement toward success or setback occurs slowly. The fluid phase (chance-taking) is the area in which rapid movement toward success or setback is possible. In a sense it is the area of greatest freedom of opportunity to either rise or fall.

The area between the two curves represents the mixture of the two phases where opportunity to move is greater than the solid phase but less than that found in the fluid phase. It might be called the area of "hope and

hesitancy" . . . the compromise between playing a thing as safe as possible or taking the "big" chance.

The horizontal axis represents all possible mixtures of "willingness to venture" and "demand for security" that an individual has at his disposal in the approach to any problem. And vertical axis represents the threshold values at which the solid solution of venture-willingness/security-demand melts and opportunity becomes fluid and available.

Naturally, the more security assurance an individual demands in a given approach, the higher the melting point of opportunity. Or, putting it another way, the same rigid structure that makes a situation secure also holds back the movement to the area of greater opportunity. The lower curve therefore is the melting point curve; the boundary at which opportunity begins to loosen up and flow easily.

The upper curve corresponds to the crystallization-point curve of the physical chemistry diagram. In the analogy used here it represents the boundary where the last solid resistance to quick movement to opportunity disappears and the individual is completely free to sink or swim in fluid opportunity.

If he fails, he will usually seek to return to the more solid areas (but of slower movement). As he moves toward these areas he will first meet (and welcome) the solidity of the mixed phases. And the chances are that if he took his bad experience to heart he will continue on until he again feels "safe" in the midst of the solid phase where the larger component is the "demand for security." In fact he will probably increase the  
(Continued)



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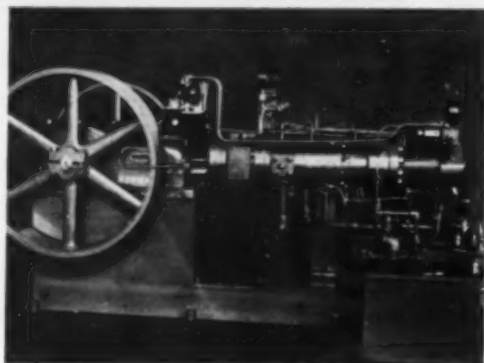
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### HUMAN EQUATION, cont. . .

amount of this component appreciably in any future drives to quick opportunity. He is a burned child.

Most of us in our daily decisions fall in the area of mixed phases. We want to play it safe on one hand and yet look with hunger at the chance of quick success that lies in the other. It is truly the area of hope and hesitancy from which we take minor excursions into the fluid phase to try our luck. But in the back of our minds we nurse the thought of scurrying back to the solid ground if the going gets too tough.

Perhaps in a way it is just as well that this intermediate attitude gener-

### JOB ATTITUDE QUIZ

(Security vs. Venture)

Circle Your  
Answer

1. Do you object to working irregular hours at least one day a week? ..... Yes No
2. Do you welcome sizable increments of responsibility (with commensurate remuneration)? ..... Yes No
3. Do you feel that company benefits (insurance, pensions, etc.) are as important as job satisfaction and take-home pay? ..... Yes No
4. Do you think seniority-based methods of promotion are a hindrance to the achievement of your goal? ..... Yes No
5. Do you ever take personal (off-the-job) problems to your superiors? ..... Yes No
6. Do you like to develop and recommend the promotion of subordinates as fast as their abilities and opportunities permit (without regard to a conventional rate of advance)? ..... Yes No
7. Do you like to specialize in one aspect of your field of work or training? ..... Yes No
8. Do you ever differ (courteously but directly) with your superiors? ..... Yes No
9. Do you prefer to work for a large company rather than a small one (other things being equal)? ..... Yes No
10. Do you have any plans or hopes of someday owning and operating your own business? ..... Yes No
11. Do you hesitate to work up or suggest unasked-for programs or methods to your superiors? ..... Yes No

(Check your answers on the next page)

## QUIZ SCORING

Scoring: With the exception of question 10, give yourself one point for each "no" answer circled for odd-numbered questions and each "yes" answer circled for even numbered questions. If your score is 3 or below, the chances are you are security-minded toward your job; if score is 4 to 7 (inclusive) you're in the "neither dare-not-play-safe-too-much" zone; and if your score is 8 or over you can consider yourself quite venturesome.

But . . . if you answered question 10 affirmatively forget the rest of the test . . . there's no doubt about it, you are willing to venture.

ally exists. Many severe personality disorders are symptomized by a complete withdrawal from the area of decision making. Similarly other equally severe disorders are characterized by an erratic flightiness of thought and a constant flow of changing venturesome decisions. The middle ground in most instances provides the best position.

## "SECUROCRATS"

But of more general consequence is the fact that many thinkers are sincerely worried about the wholesale demand for security that has developed about matters regarding salary and welfare in the industrial population of the country. An article in the October 1950 *Management Review* goes so far as to call a follower of this trend, a "Securocrat" . . . claiming that "one of his dominant traits is an all prevailing preference and desire to play it safe, and his mind is security conditioned from birth."

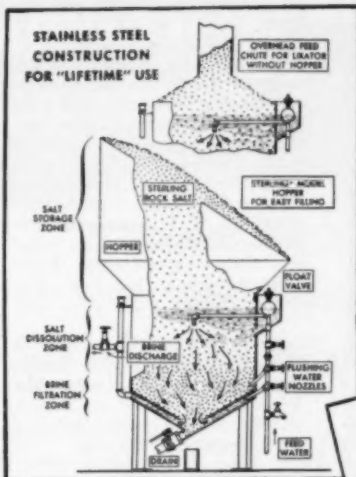
The big danger of the securocratic attitude is that it is making inroads into the ranks of both government and management leadership material. A recent survey of junior executives in industry revealed that almost 85 percent of them desired no increment of responsibility (with commensurate pay increase). Many of them preferred to stay at their present level and look forward to a future of small salary increases based on seniority of service.

Another symptom of the same trend is found in the nostalgic remarks of many young veterans about the "easy, planned routine of military life." In fact several of them openly admit that they would enjoy returning to the system that obviated those difficult decisions of what weight clothing to wear and when and what to eat.

The whole thing grows more ominous when the psychologists' opinion that only about 5 percent of the population has the qualities necessary to lead and direct the work of others is considered. If this small group is ever infected by a penchant for securocracy, decisions will go begging for deciders.

—End

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## Names in the News Edited by Frances Arne

**Bruce W. Gonser.** Assistant director in charge of research on the less common metals, Battelle Institute, Columbus, Ohio. Continues to direct research in nonferrous metallurgy. Joined Battelle in 1934. Before that: American Smelting and Refining Co., Superior Zinc Corp., National Radiator Corp. Studied at Purdue and the University of Utah.



B. W. Gonser J. A. Scott

**John A. Scott.** Head of the newly-created petroleum chemicals division, Sinclair Refining Co. Joined Sinclair in 1934 as chemical engineer in the research and development department. Most recently, assistant to the vice president in charge of research and development, New York. Graduate of the University of Minnesota.

**Clifford F. Rassweiler.** Vice chairman, Johns-Manville Corp.; has been vice president of research and development since 1942. Previously, director of Du Pont's paint laboratory in Philadelphia. Studied at the Universities of Denver and Illinois (Ph.D. in organic chemistry).

**L. M. Cassidy.** President, Johns-Manville Corp.; has been vice president for sales since 1946. Joined the firm in 1926. Newly elected director: **Adrian R. Fisher**, vice president for production and general manager of the asbestos fiber division.

**Walter A. Schmidt.** A director-at-large of ACS; re-elected to this post which he has held since 1943. President and general manager of Western Precipitation Co., Los Angeles. With the company since 1908. Graduate of the University of California.

**J. Herbert Babcock.** Vice president, Hooker Electrochemical Co. Started with Hooker in 1916 as a research chemist; subsequently, manager of

research, manager of development and research. Recently supervised development of processes for making benzene hexachloride and lindane.

**George H. Baker.** Member of the manpower committee, Manufacturing Chemists' Assn.; associated with Wyandotte Chemicals. Other new association committee members: **V. N. Wilson** of Pennsalt, manpower committee. **J. T. Morris** of Commercial Solvents, general safety committee. **F. L. Seamans** of Aluminum Co. of America, air pollution abatement committee. **Louis Klein** of Rohm & Haas, resin adhesives committee.

**George W. Steahly.** Group leader in Monsanto's organic division research department in St. Louis, Mo. Joined the firm in 1941 as a research chemist. Studied at Ohio State and the University of Nebraska.

**Frederick D. Rossini,** ACS representative on the council of the AAAS. Head of Carnegie Tech's chemistry department. Chief of the section on thermo-chemistry and hydrocarbons, National Bureau of Standards, until 1950.

**W. P. Willis, Jr.** Manager of Monsanto's plant at Santa Clara, Calif. Joined Monsanto in 1941. Has been branch manager, special products department, Los Angeles. Formerly, research chemist for I. F. Laucks Inc., Seattle. Graduate of Montana State College. New special products branch manager: **L. W. Miller.**

**A. Leggin.** Assistant to the president, Wyandotte Chemicals Corp., Wyandotte, Mich. Formerly, assistant to the vice president in charge of research and development. To head up Washington activities involved in the company's planning for its part in the industrial mobilization program.

**I. N. Lanning** and **J. H. Houlette.** Recent additions to the chemical division staff of Goodyear Tire & Rubber Co., Akron. Graduates in chemical engineering of Iowa State and Northwestern, respectively.

**William E. Johnson.** Assistant general manager for General Electric

at Hanford. Has been head of the construction program at AEC's Hanford Works.

**J. H. Forrester.** Manager of Stanolind Oil & Gas Co.'s central division. Manager of the company's manufacturing department since 1947. Previously, associate director of research and director of technical service, Standard Oil (Indiana). Graduate of the University of Wisconsin and MIT.

**Bruce E. McNay.** In charge of development project in connection with the expansion program at the East St. Louis, Ill., plant of C. K. Williams & Co., pigment manufacturers. His successor as production manager at the firm's Emeryville, Calif., plant: **Eric Ratcliffe.**

**Seton Porter** and **John E. Bierwirth.** Additional members of the board of directors and members of the executive committee, U.S. Industrial Chemicals, New York. Mr. Porter: chairman of the board of National Distillers Products Corp.; Mr. Bierwirth, president.

**L. I. Dana.** Vice president in charge of research, Linde Air Products, New York.

**Paul W. Bachman.** Director of research and development, Davison Chemical Corp. Joined Davison in 1949 as manager of development planning. Formerly with Commercial Solvents. Graduate of Johns Hopkins.



P. W. Bachman D. T. Rogers

**Dilworth T. Rogers.** Senior research associate, research division, Standard Oil Development Co. With the division since 1938 doing research on additives for lubricating oils and fuels. Studied at Rensselaer and Harvard (Ph.D. in organic chemistry).

(Continued)

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**John F. Synan.** Manager of the product development department, Mathieson Chemical Corp., Baltimore. With Mathieson since 1939. Known for his work in the development of a sodium chlorite product for textile processing and for the chlorine dioxide method for removing tastes and odors in drinking water.

**Earl Erich.** Product director for linings and coatings, Atlas Mineral Products Co., Mertztown, Pa. Formerly of the technical service department. **George Kanelis,** new member of the engineering department. Recent chemical engineering graduate of the University of Syracuse.

**E. E. Kimmel.** Technical advisor for the chemical division, Koppers Co. To coordinate all technical matters relating to the development, sale and use of products produced or contemplated for production. Has been assistant to the technical advisor. Prior to joining Koppers in 1949: research chemist in coal chemicals, Carnegie Illinois Steel Corp.; research engineer, Battelle. Graduate of Ohio State.

**W. R. Balfour.** Treasurer of Shell Development Co. Has been office manager at Emeryville. With Shell since 1923.

**L. R. Goldsmith.** Manager of the manufacturing-technological department in the New York head office, Shell Oil Co. Joined Shell's control laboratory at the Martinez Refinery in 1932. Served with the Petroleum Administration for War, 1942 to 1944. Subsequent Shell jobs: superintendent of the Wilmington Refinery; member of the economic development department, New York. Graduate of the University of California.

**G. A. Siegelman.** Manager of the alkylation department at Shell's Wood River Refinery. Previous Wood River jobs: junior technical assistant in the research laboratory; technologist; senior technologist; assistant manager of the alkylation department. Came to Wood River in 1937. Graduate of MIT.

**Deane R. Ebey.** Coordinator of defense activities for plastics, Dow Chemical Co., Midland, Mich.; has been supervisor of plastics sales in the Los Angeles office. Joined Dow's cellulose and plastics sales di-



Palette and brush shut out the din of priorities, allocations, wage controls, for . . .

### MAN OF THE MONTH: Francis J. Curtis

. . . Monsanto's director of industrial preparedness in Washington; Winner of CCDA Honor Award for 1951.

An old hand at tough administrative problems was needed to guide Monsanto's fortunes through the jungle of government bureaus when the war emergency arose last year. In cigar-smoking vice president Frank Curtis they had a man who filled the bill and to spare. He'd had 35 years of varied executive experience with the company. He had a well-proven capacity for retaining the important details with which Washington is so abundantly supplied. And he had inexhaustible common sense and Irish good humor, perhaps most valuable of all.

Mr. Curtis joined the research department of Merrimac Chemical Co. in 1915. He had just received his degree in chemistry from Harvard, an institution for which he maintains boundless enthusiasm. He held positions in production and sales in Merrimac, which was acquired in 1929 by Monsanto. In 1935 he transferred to the St. Louis general offices as assistant director of development. Setting up the manufacture of styrene and elemental phosphorus was in his bailiwick. He revamped policies on hiring technical men on the premise that new personnel of broadly divergent backgrounds is a company's best insurance against stagnation. Monsanto

began to send five or six men on systematic swings around the American universities to interview each job applicant.

In 1939 he was appointed director of development, in 1943 vice president and secretary of the executive committee. He has served as coordinator of the company's long-range program of future development here and abroad. The Army's Chemical Warfare Service sent him to Germany in 1945 with a group of technical investigators. He's an ardent promoter of Anglo-American relations—a past chairman of the American section of the Society of the Chemical Industry and in 1947 its Jubilee Memorial Lecturer in London.

The job of coordinating Monsanto's advertising and sales programs fell to Mr. Curtis in 1948. He's been at his present post in Washington since last August. This month he takes time out to go up to New York to receive his CCDA award.

Frank Curtis is known throughout the chemical industry for his loyalty to his friends and for his amazingly wide acquaintance. Thus he is known to a formidable number of friends' wives—as the industry's No. 1 bachelor and prime target for matchmaking onslaughts. However they are up against a discouraging array of alien interests: water color painting (the results cover his office wall), piano playing (on his rented, \$2-a-week piano), voracious whodunit reading, and then there's his career.

vision in 1938; in 1942, priority manager of purchasing at the magnesium operation in Ludington, Mich. Graduate of the University of Illinois.

**Bruce S. Old.** Vice president of Arthur D. Little, Inc., Cambridge, Mass. Has been in charge of process metallurgy since joining the firm in 1946; director since 1949. Dur-

ing the war, head of the sections on guided missiles and metallurgy and materials, Office of Coordinator of Research and Development, USNR. Graduate of the University of North Carolina and MIT.

**J. Alfred Hall.** Director of the Forest Products Laboratory, Madison, Wis.; has been director of the Pacific Northwest Forest and Range



Experiment Station, Portland, Ore., for six years. He succeeds George M. Hunt, retiring after 40 years in the Forest Service. Noted for his studies of wood preservation, painting, gluing and fireproofing.

**Harry E. Hartzell.** To supervise production activities of Hercules Powder Co.'s British operations. Formerly, operating assistant for the cellulose products department. Joined Hercules in 1926 as a chemist; manager in 1938-39 of Holden Vale Mfg. Co., Haslingden, England, chemical cotton producers, partly owned by Hercules. Graduate of Pennsylvania State.

**A. L. Geisinger.** Vice president, Diamond Alkali Co., Cleveland. To have charge of the firm's activities in the field of organic chemistry. Continues as president of Martin Dennis Co., Diamond division. Joined Diamond in 1919. Designed, supervised construction and later operation of six of the company's silicate plants. During World War II, president of the Diakel Corp., a joint project of Diamond and M. W. Kellogg to operate a large fluid catalyst producing plant at Cincinnati. Graduate of Ohio State.

**Vernon R. Childress.** Manager of sales analysis and planning for the chemicals division of GE's chemical department. Formerly with: B. F. Goodrich in research, materials control and sales service capacities; O'Sullivan Rubber Co. as manager of plastics sales. Graduate of Alabama Polytechnic Institute.

**Thomas M. Gow.** Assistant to the head of the coatings section, plastic sales division, Dow Chemical Co., Midland, Mich. Formerly coatings salesman for the New York area. Graduate in chemical engineering at the University of Tulsa. Successor in New York: Ross D. Visger.

**A. E. Whitney, Jr.** Special representative of the chemical division, Good-year Tire & Rubber Co., with headquarters in New York. Chemical engineering graduate of Newark College of Engineering.

**Robert P. Kenney.** To organize a new unit within the plastics section of the National Production Authority to establish and direct certain plastic materials controls and distribution. On leave of absence as chemical sales manager of B. F. Goodrich Chemical Co. with Goodrich (Continued)

**NEW HEAT SAVING EFFICIENCY**

Mundet 85% Magnesia Insulation provides attractive smooth finish... precise fit... maximum strength and resistance to vibration.

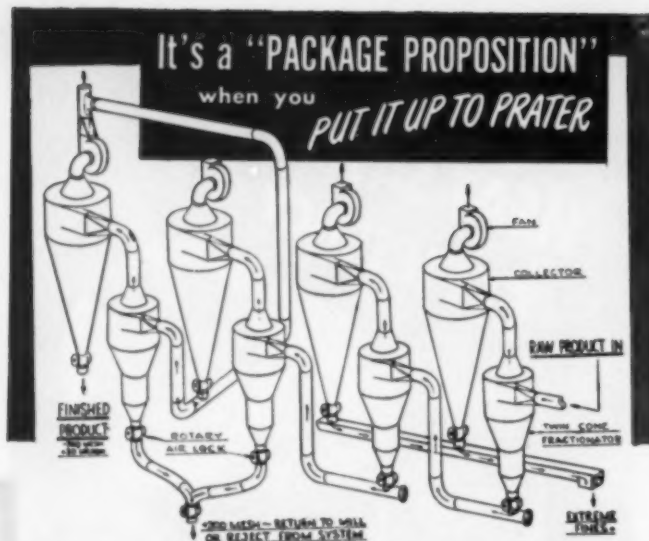


New heat saving efficiency is provided by Mundet Custom Molded 85% Magnesia Pipe Covering. Extra durability is built into this insulation. It is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7111 Tonnelle Avenue, North Bergen, New Jersey.

## INSULATION FOR HIGH & LOW TEMPERATURE

Mundet district offices are located in these cities:

<b>ATLANTA</b> 329-41 Elizabeth St., N.E.	<b>CINCINNATI 2</b> 427 West 4th St.	<b>INDIANAPOLIS</b> 15 E. Washington St.	<b>NEW ORLEANS 16</b> 315-25 N. Front St.
<b>BALTIMORE 30</b> 612 Battery Ave.	<b>DALLAS 1</b> 601 Second Ave.	<b>JACKSONVILLE 6, FLA.</b> 800 E. Bay St.	<b>NEW YORK 17</b> 321 Madison Ave.
<b>BOSTON</b> 57 Regent St., R. Cambridge 40	<b>DETROIT 21</b> 14401 Prairie St.	<b>KANSAS CITY 7, MO.</b> 1401 St. Louis Ave.	<b>PHILADELPHIA 39</b> 856 N. 48th St.
<b>CHARLOTTE, N. C.</b> 507 S. Cedar St.	<b>HOUSTON 1</b> Commerce and Palmer St.	<b>LOS ANGELES</b> (Maywood): 6116 Walker Ave.	<b>ST. LOUIS 9</b> 3176 Brunson Ave.
<b>CHICAGO 14</b> 2601 Cottage Grove Ave.	In Canada: Mundet Cork & Insulation, Ltd. 35 South Ave., Toronto		
			<b>SAN FRANCISCO 7</b> 440 Brunson St.



### PRATER FOUR-STAGE FRACTIONATING SYSTEM

This closed circuit system will grind and fractionate in one continuous operation. It's all Prater — Dual Screen Pulverizer (not shown) . . . Twin Cone Fractionators . . . Heavy Duty Collectors . . . and Rotary Air Locks. Fans may be vented to atmosphere or piped to bag filter.

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PRATER PULVERIZER COMPANY  
1517 S. 35th Court, Chicago 50, Ill.



**OIL**—in drums, cans, cartons—moves continuously, without effort or attention, from packers to storage to shipping platform on Standard roller conveyors.

Many nationally known oil companies and processing plants look to Standard for their conveyor requirements—engineered power and gravity systems, portable units, special equipment.

**STANDARD CONVEYOR COMPANY**  
General Offices—North St. Paul, Minn.  
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Engineered Conveyor Systems—Portable Conveyor Units—Spiral Chutes—Pneumatic Tube Systems.



Write, telling us what you make or handle. We will send literature showing Standard Conveyors in use in your business. Address Dept. CM-110.



### NAMES IN THE NEWS, cont. . .

since 1944. During World War II, chief of the vinyl resins unit in the chemical bureau of WPB.

**John G. Armistead.** Manager of Du Pont's New Brunswick, N. J., plant. Formerly chief supervisor of the naphthalene area at the company's Deepwater Point, N. J., plant.

**Robert H. Owens.** President and general manager, Roots-Connersville Blower Corp., Connersville, Ind. Elected to the board of directors in 1948. Joined the company's engineering staff in 1925. Graduate of Purdue.

**Edwin R. Bartlett.** Chairman of the board of Hooker Electrochemical Co., Niagara Falls; has been president since 1945. President and a director of Hooker-Detrex, Inc. Joined Hooker in 1907; vice president and director, 1924. Mr. Bartlett's successor to the presidency: R. Lindley Murray; with Hooker since 1916, a director since 1937. Vice president and director of Hooker-Detrex.

**Donald A. Roper.** Assistant chief engineer, Monsanto's phosphate division in Anniston, Ala. Formerly design engineer at the Anniston plant. Graduate of the University of Texas.

**William J. Youden.** Fellow in the New York Academy of Sciences. Chemist and mathematician in the statistical engineering section of the National Bureau of Standards.

**Edward G. Egan.** Head of American Mineral Spirits Co.'s chemical department. Responsible for sales of the company's complete line of chemicals. Formerly sales executive and chemical broker for the organic chemical division, Celanese Corp.

**N. V. Hendricks.** Director, industrial hygiene section, medical research division, Standard Oil of N. J. Joined Standard as industrial hygiene engineer in 1947. Formerly: engineer for Borden Co., Lewisburg, Tenn.; senior sanitary engineer, Tennessee department of health; assistant director, division of industrial hygiene in Georgia department of health. Studied chemical engineering at Vanderbilt; graduate work in industrial hygiene at Harvard.

**Frederick G. Keyes.** Vice president and director of Alfred Bicknell As-  
(Continued)



## engineers who design for long life specify TRENTWELD

Here are 7 reasons why TRENTWELD is better

1. Largest variety of sizes—4½" to 30" inclusive
2. Finished tubing... machine-formed, machine-welded, machine-sized for uniformity
3. Made in a tube mill by tube experts
4. Made from tested cold rolled sheets... completely fused into finished tubing *without* added rod metal
5. No zone of weakness for corrosion to attack
6. Uniform section, metallurgically correct
7. Available for fabrication with any fittings

Trentweld Large Diameter (4½" to 30") Stainless Steel Tubing should not be compared to rolled up and hand welded sheets: Trentweld tubing is machine formed and machine welded without metal added. The weld is fused to the parent metal by an exclusive Trent development. That's what makes the difference, and that's why more and more fabricators, designers and manufacturers of all types of processing equipment are turning to Trent for their tubing requirements.

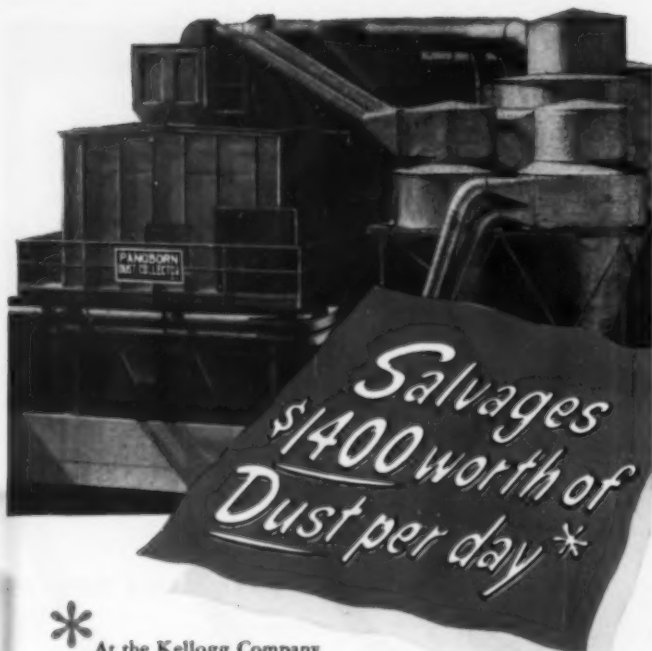
When you do business with Trent, you get top quality tubing PLUS engineering assistance to put stainless tubing to work in your application... better! Write for Trentweld Data Bulletin and tell us the application you have in mind.

### TRENT TUBE COMPANY

Subsidiary of Crucible Steel Company of America  
General offices and plant: East Troy, Wisconsin  
Sales offices in principal cities

# TRENTWELD

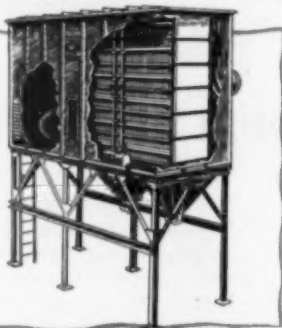
## STAINLESS STEEL TUBING



At the Kellogg Company of Battle Creek, Mich., this Pangborn Dust Control system salvages 35 tons of valuable dust per day. Collected from the corn mill and the Gro-Pup building, the dust is valued at \$40 a ton... building a profit of \$1400 a day for Kellogg!

### Here's how Pangborn makes Dust Control profitable for industry!

Pangborn Dust Collectors make low-cost dust control possible. As this cutaway shows, type "CH" Collectors are compact, offer maximum filtering area in a given size. Filter life is prolonged because dust-laden air passes through collector at low velocity. Efficiency is extremely high; in fact, clean exhausted air can often be returned direct to plant.



**FIND OUT** how Pangborn Dust Control turns dust into profits. Write for a copy of Bulletin 909A to: PANGBORN CORPORATION, 2600 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment



**STOP THE DUST HOG**  
from stealing profits with

**Pangborn**  
**DUST CONTROL**

### NAMES IN THE NEWS, cont. . .

sociated; has been chairman of MIT's department of chemistry for 23 years. Noted for his work on thermodynamic properties of matter, kinetic theory of matter, applications of thermodynamics to problems of chemical equilibria.

**William J. Burkett, Jr.** Staff member, Southwest Research Institute. Graduate in chemical engineering from the University of Michigan.

**S. R. Sapirie.** From deputy manager to manager of AEC's Oak Ridge operations. Associated with the atomic energy project for over five years.

**John C. Redmond.** Vice president in charge of metallurgical development, Kennametal Inc., Latrobe, Pa. Formerly: research director, Kennametal; research engineer, Youngstown Sheet and Tube Co.

**Tom B. Nantz.** Plant manager at the government synthetic rubber plant at Institute, W. Va., operated by B. F. Goodrich Chemical Co. Joined Goodrich in 1937. During World War II, manager of technical service at company-operated Lone Star Defense Corp. ordnance plant at Texarkana, Tex. General foreman at the GRS plant; most recently, production manager of Hycar American rubbers at the Geon plant, Louisville. Graduate of the University of Kentucky.

**Walter E. Brodine.** Plant engineer, government synthetic rubber plant at Institute, W. Va., operated by B. F. Goodrich Chemical Co. Formerly engineer at the company-operated government GRS plant at Port Neches. Joined Goodrich in 1943.

**Sigmund S. Michels.** Technical manager, government synthetic rubber plant, Institute, W. Va., operated by B. F. Goodrich Chemical Co. Formerly at the company-operated government GRS plant at Port Neches. Joined Goodrich in 1942 with a chemical engineering degree from the University of Michigan. Production manager at the Louisville plant: **Anton Vittone.** Formerly production manager of vinyl materials at company's Louisville plant. Joined Goodrich in 1942 after several years with Wyandotte Chemicals. Graduate of the University of Washington.

**W. B. Thompson.** Manager of the newly created development depart-

ment of Dominion Tar & Chemical Co. Ltd. To study trends in the chemical industry and to recommend long term policy as to fields of expansion. Formerly managing director and vice president, Nichols Chemical Co. Ltd.

**Gilman S. Hooper.** Assistant manager of high polymer research, Industrial Rayon Corp., Cleveland. Joined the firm's high polymer research staff in 1949. Previously associated with Du Pont for 15 years in the acetate division of the rayon department. Studied at Colby College and Brown University.



G. S. Hooper



S. J. Gullo

**Stephen J. Gullo.** Assistant vice president in charge of the bottle product control department, Pepsi-Cola Co., New York. Joined Pepsi-Cola in 1947. Previously associated with: Liquid Conditioning Corp. in technical sales capacity; Coca Cola Co. as a chemist. Studied at Brooklyn College and Polytechnic Institute of Brooklyn.

**Lewis H. Sarett.** To receive the Leo Hendrik Baekeland Award of the ACS's north Jersey section for 1951. First to synthesize cortisone, in 1946. With Merck's research and development division since 1942. Studied at Northwestern and Princeton, Ph.D. 1942.

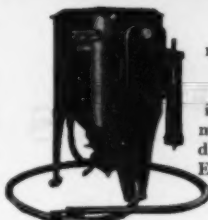
**Robert M. Radford.** Chief chemist, analytical division, National Dairy Research Laboratories, Oakdale, N. Y. Former National positions: acting head of analytical division; chemist in Baltimore research laboratories.

**Harold A. Idles.** To do research in organic chemistry at the University of Wisconsin during a semester's sabbatical leave from the chairmanship of the chemistry department, University of New Hampshire. Doctorate in chemistry from Columbia, 1925. With New Hampshire since 1929.

**David C. Timberlake.** Member of the engineering department, fire extinguisher division, Ansul Chemical (Continued)

Here's  
**BIG  
NEWS**

**Blast Cleaning Unit  
is PORTABLE!**



Ideal for maintenance and many other jobs, including removal of rust, dirt, scale, etc. Economically cleans large objects like tanks, bridges, structural work before painting. Six sizes, stationary or portable, from . . . . \$170.00 and up

**Blast Cleaning  
Dust Control  
Precision Finishing**

**Hydro-Finish  
SPEEDS POLISHING!**



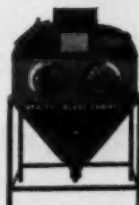
Removes scale, and directional grinding lines . . . prepares surfaces for plating and holds tolerances to .0001"! Liquid blast reduces costly hand cleaning and finishing of molds, dies, tools, etc. Models from \$1295.00 and up

**STOP DUST  
at the SOURCE!**



Pangborn industrial type Unit Dust Collectors trap dust at source. Machine wear is minimized, housekeeping and maintenance costs reduced. Solves many grinding and polishing nuisances and material losses. Models from \$206.00 and up

**COMPACT Blast Cabinet  
for SMALL WORK!**



Ideal for producing smooth, clean surfaces on pieces up to 60" x 36" in size. Cleans metal parts, removes rust, scale, grime, dirt, paint, etc., in a few seconds. Saves money all year 'round. Models from \$315.00 up

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

**Pangborn**

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COUPON  
FOR DETAILS

Check for more information

- ☐ Blast Cleaning Cabinets
- ☐ Blast Cleaning Machines
- ☐ Unit Dust Collectors
- ☐ Hydro-Finish Cabinets

PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md. Gentlemen: Please send me more information on the equipment I've checked at the left.

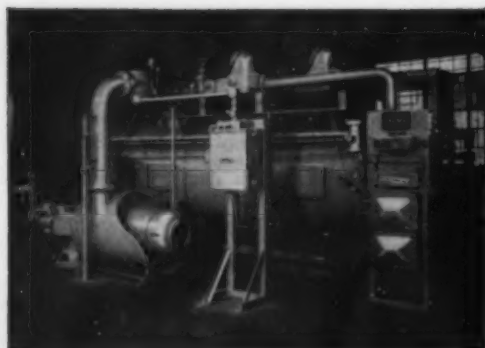
Name . . . . .

Company . . . . .

Address . . . . .

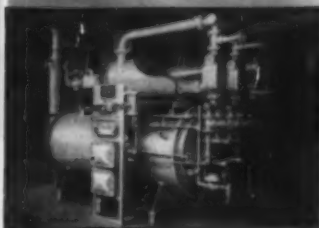
City . . . . . Zone . . . . . State . . . . .



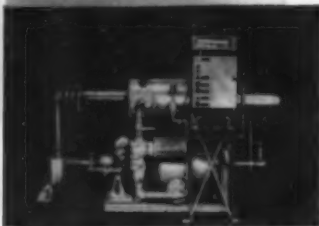


Model 60 HNH produces 60,000 cfh ... is widely used for purging and blanketing in the petroleum industry.

## Why Pay Premium Prices For Inerts?



Model 6 HNH is ideal for purging, blanketing and blanketing in synthetic resin plants ... delivers 6000 cfh.



Model 1 HNH offers all the features of larger equipment ... delivers 1000 cfh ... is fully automatic.

### KEMP Inert Gas Producers Can Save You up to 90% on Inert Gas Costs

Whether you now use bottled inerts or produce them with old-fashioned equipment, switch to a Kemp Inert Gas Generator and save 83% to 90% on your inert gas costs. Kemp Inert Gas Producers and Kemp Nitrogen Producers are available in standard models with capacities ranging from 500 to 200,000 cfh for fully automatic operation.

#### ABSOLUTELY DEPENDABLE

No matter what the demand, Kemp Inert Gas Generators give you the same analysis Inert Gas from 20% to 100% of capacity. The Kemp Industrial Carburetor, part of each installation, burns ordinary gas just as it comes from the mains. Assures complete combustion without "tinkering." Produces a clean, chemically inert gas to meet your most exacting requirements.

#### SEND FOR DATA

Whatever your requirements, always specify Kemp. To find out how you can benefit: Tell us your atmosphere gas problem, and we'll show you how Kemp can solve it and save you money!

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OF BALTIMORE

### INERT GAS GENERATORS

Write for Bulletin 1-10 for technical information.  
C. M. KEMP MFG. COMPANY,  
405 E. Oliver St., Baltimore 2, Md.

CARBURETORS • BURNERS • FINE CHECKS • AIR/OXYGEN • GASEOUS MIXTURES  
ABSORPTION REACTORS • METAL MELTING UNITS • DRYING EQUIPMENT • SPECIAL REQUIREMENTS

#### NAMES IN THE NEWS, cont. . .

Co., Marinette, Wis. To work on design and installation of new automatic piped systems. Formerly with Underwriters Laboratories.

**William T. Wood.** Assistant manager in charge of Fiber V operations, in Du Pont's nylon division. Formerly the division director of production. Started with Du Pont in 1924; supervised construction of first nylon yarn plant at Scaford in 1939. Lafayette graduate. New director of production for nylon: Charles E. Mears. His successor as manager of the Nylon plant at Chattanooga: Edgar H. Bleckwell.

**D. A. C. Dewdney.** Coordinator of refinery operations, Anglo-American Oil Co. Ltd., London. Research manager of Esso Development Co. since 1949. Before joining Esso in 1936: refinery chemist in the Middle East. Graduate of Birmingham University.

**R. W. Hooker.** First vice-president of the Compressed Gas Association; reelected president of the Chlorine Institute. Vice president in charge of sales, Hooker Electrochemical Co., Niagara Falls.

**Paul T. Truitt.** President of the American Plant Food Council, fertilizer trade association. Former president of the National Association of Margarine Manufacturers.

**James A. Reid.** Assistant manager, office of production, Reconstruction Finance Corp. On leave of absence as assistant director of research for Phillips Petroleum Co. Joined Phillips in 1933 as research chemist. During World War II, served with Rubber Reserve Co. for two years.

**H. E. Weightman.** To work on AEC project with chemical plant division of Blaw-Knox Construction Co., Pittsburgh, Pa.

**Paul F. Pie, Jr.** Superintendent of the Marshall, Tex., activated carbon plant at the Darco department, Atlas Powder Co. Prior Atlas locations: Darco research laboratory; Kentucky Ordnance Works; Marshall, Tex., as assistant superintendent. Graduate of the University of Delaware.

**George M. Walker.** Assistant vice-president, chemical division, Koppers Co. Has been head of the control section. Joined Koppers in 1929.

(Continued)

**IT MUST BE**

*Continuous*

**TO BE PROFITABLE!**



### Why De Laval?

De Laval has over 70 years experience in solving problems of separation and clarification. Your problem may be quite similar to one that has already been solved by De Laval centrifugals. It will pay you to ask.

A conveyor belt takes the lost motion out of materials transfer . . . a De Laval Centrifugal Separator takes the lost time out of the separation phase of a chemical process by making it continuous. Often De Laval machines will do in seconds by means of centrifugal force work that once took hours by settling or filtration.

An important part of De Laval's service to the Process Industries is the ability to provide exactly the right machine for the purpose. Almost every industrial mixture presents its own specifications—specific gravity . . . viscosity . . . the quality and quantity of solids present. Whether the machine need separate only a few gallons per hour of a liquid mixture, or if a "Nozzle-Matic" unit capable of handling 6,000 gallons per hour is required, De Laval engineers have the right machine for the job.

THE DE LAVAL SEPARATOR COMPANY  
165 Broadway, New York 6 427 Randolph St., Chicago 6  
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5  
THE DELAVAL COMPANY, Limited, Peterborough, Ont.



*De Laval*

**CONTINUOUS CENTRIFUGAL  
SEPARATORS & CLARIFIERS**

**FOR FASTER PROCESSING SYSTEMS**

SPARKLER FILTERS-SPARKLER FILTERS

# Quality ... Filtration

## SPARKLER FILTERS

High quality, sharp filtration has always been one of the prime features of Sparkler Filters. Many times Sparkler Filters have been chosen by experienced filtration engineers for this one point of superiority.

### Here's why

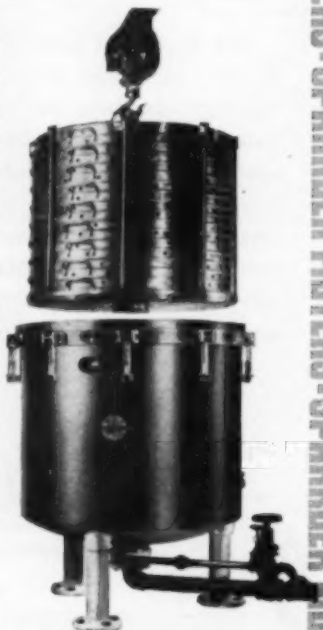
... any kind of filter paper, cloth, or screens, and any filter media can be used to obtain maximum efficiency.

... no breakage of the filtering surface even with intermittent operation as pressure is not required to hold cake in position on the horizontal plates.

... flow is always with gravity, down through the cake in a natural direction. The cake will not break, crack or slip because it is supported in a horizontal position and is not subject to tensile or distortive strain.

When you are looking for fine quality filtering, Sparkler Filters will do the job.

For personal engineering service write Mr. Eric Anderson.



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representatives  
in all principal  
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**SPARKLER MANUFACTURING CO.**  
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Makers of  
Filters for the  
Chemical,  
Pharmaceutical,  
Food and  
Petroleum  
Industries  
for over  
a quarter of a  
century.

### NAMES IN THE NEWS, cont. . .

**C. W. Bendigo.** With the new product development department of American Cyanamid. To study current developments in the field of synthetic fibers. For the past five years, editor in chief, *Textile World* magazine.

**R. U. Haslanger.** Manager of the sales department of Monsanto's Texas division, Texas City. Joined Monsanto in 1939. Subsequently: engineering and general development department, St. Louis; assistant to the president at the company's general offices; assistant to the general manager and assistant general manager, western division. Graduate of the University of Wisconsin.

### OBITUARIES

**Walter Geist,** 56, president of Allis-Chalmers Mfg. Co., Milwaukee, died January 29. He had been with the company since 1909, president since 1942.

**Yellott F. Hardcastle,** 67, director of Pennsylvania Salt Mfg. Co., Philadelphia, died February 4. He joined Pennsalt's engineering department in 1909, became vice president in charge of manufacturing in 1928, director in 1948.

**Sievert A. Rohwer,** 62, outstanding entomologist in the Agriculture Department's Agricultural Research Administration, died February 12. He had been with the department since 1909 in such capacities as assistant chief of the Plant Quarantine and Control Administration and assistant chief of the Bureau of Entomology.

**Robert C. Stanley,** 74, chairman of the board of directors of the International Nickel Co. of Canada, Ltd., died in Staten Island, N. Y., February 12. He had been with the company since 1901. Monel was discovered in 1905 by Mr. Stanley who conceived and developed the process of producing the alloy direct from ore without separating the nickel and copper.

**Richard F. Warren, Jr.,** 58, senior project engineer, Raybestos Division of Raybestos-Manhattan, Inc., died at his home in Stratford, Conn., February 16. Before joining Raybestos he was with Barrett Division of Allied Chemical & Dye Corp. He previously served as a consulting chemical engineer for Industries of America, a subsidiary of American Chain & Cable Co.

*Air-and-Moisture-sensitive  
products should be  
processed under Vacuum*

Vacuum Processing eliminates moisture, works at lower temperatures, saves labor, lengthens life, makes finished products highly resistant—often impervious—to air, moisture, and the effects of prolonged humidity.

Products can be totally or controllably dried, impregnated, distilled, evaporated and metallized under vacuum in less time at less cost for labor than by other processes . . . and at temperatures which do not impair chemical or physical properties.

Among the larger groups of products so treated are electrical parts . . . laminated paper sheets, condensers, coils, capacitors, armatures . . . to give permanent high level dielectric characteristics not economically attained by any other method.

Picture shows compact Stokes Vacuum Impregnator in which hundreds of small electric parts are treated at a single operation. One man can handle production on a dozen such units on a staggered cycle, treating thousands of parts per day.

Stokes is the only manufacturer of complete vacuum systems and Stokes engineers are experienced counsellors . . . ready to work with you on any application of Vacuum Engineering.

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F. J. STOKES MACHINE COMPANY, 2925 TADON ROAD, PHILADELPHIA 20, PA.

**STOKES MAKES**

Plastics Molding Process,  
Industrial Tabletting  
and Powder Metal Process,  
Pharmaceutical Equipment,  
Vacuum Processing Equipment,  
High Vacuum Pumps and Gages,  
Special Machinery

Stokes  
Vacuum Impregnator  
dries and impregnates small  
electrical parts with varnish at  
Synthane Corporation, Ocala, Fla.

## INDUSTRIAL NOTES

### NEW FACILITIES

**Kennametal Inc.**, Latrobe, Pa.—A district office in Minneapolis to handle its cemented carbide products in that area. Harry Brandvik is in charge.

**Hagan Corp.**, Pittsburgh—A Chicago district office for itself and subsidiaries: Hall Laboratories, Calgon, Inc., Buromin Co.

**Flintkote Co.**, New York—A Washington, D. C., office for its industrial products division headed by Hayden A. Glatte.

**Allis-Chalmers Mfg. Co.**, Milwaukee—A wholly-owned Canadian subsidiary through the purchase of Canadian Allis-Chalmers, Ltd., Lachine, Que. The firm will continue to produce hydraulic turbines, centrifugal pumps and other heavy machinery for the Canadian market.

**Walter Kidde & Co.**, Belleville, N. J.—A branch sales office in Los Angeles.

**Blaw-Knox Co.**, Pittsburgh—A resins and plastics department for its chemical plants division. Headed by Arne Olson, the department will specialize in design and construction of complete plants for the manufacture of all types of synthetic resins including alkyds, phenolics, urea, melamine, polyvinyl chloride and polystyrene.

**Gulf Oil Corp.**, New York—Additional equipment at its Port Arthur refinery for the production of 9 million lb. per year of iso-octyl alcohol. Facilities are expected to be in operation by the end of 1951.

**Emery Industries, Inc.**—A branch office in San Francisco to provide direct sales and technical service coverage of the West Coast area for stearic acids, oleic acids, other fatty acids and soluble oil bases. L. J. Hadobas will handle the office.

**Barry Corp.**, Watertown, Mass.—A department to assist customers in the solution of problems in shock and vibration isolation. Sheldon E. Young is manager.

**Burgess-Manning Co.**, Libertyville, Ill.—A Dallas, Tex., office to handle sales, engineering and development in the petroleum industry of its ex-

haust and air line snubbers and noise abating products.

**Patterson Foundry & Machine Co.**, East Liverpool, Ohio—A district sales office in Denver to provide specialized service to the users of its grinding, blending and other chemical processing equipment in Colorado, Utah, New Mexico and Wyoming.

**Sealol Corp.**, Providence, R. I.—A subsidiary company, Sealol Mfg. Co., Keene, N. H. Research engineering and sales of mechanical seals for rotating shafts will continue to be handled at Providence.

**Witco Chemical Co.**, New York—A defense products division to coordinate defense efforts throughout the company. The objective is to supply government agencies with information requested on productive capacity, schedule of operations and personnel available for investigation of new processes and products.

**Bellows Co.**, Akron—A West Coast regional headquarters in Los Angeles to handle field engineering services and sale of its industrial pneumatic devices.

**Black, Sivalls & Bryson**, Kansas City, Mo.—A Buffalo, N. Y., office to cover western New York and nearby Pennsylvania counties.

### NEW NAMES

**K-G Welding & Cutting Co.**, New York, has changed its name to K-G Equipment Co.

**Chemco Products Co.**, Lyons Ill., has changed its name to Perlon Corp. The company manufactures foundry core oils, metal cutting and grinding compounds, metal cleaners, paint strippers.

**Lupomatic Industries, Inc.**, New York, has changed its name to Tumb-L-Matic Inc.

### NEW LOCATIONS

**Ray Miller, Inc.**, supplier of pipe, valves, fittings and tubing made in various corrosion resistant materials, has moved to 252 North Tenth St., Newark, N. J.

**Pennsylvania Salt Mfg. Co.**, Philadelphia, has moved its Appleton, Wis.,

district sales office to the Irving Zuelke Bldg.

**Commercial Solvents Corp.**, New York, will move its general offices to 260 Madison Ave., next fall.

**Harper Electric Furnace Corp.**, Buffalo, has moved its offices and plant to 39 River St.

### NEW LINES

**Barrett-Cravens Co.**, Chicago—Electric industrial trucks and tractors as a result of its merger with Crescent Truck Co., Lebanon, Pa. The latter will be operated as a Barrett division.

**H. K. Porter Co.**, Pittsburgh—High voltage electrical equipment as a result of its purchase of Delta Star Electric Co., Chicago.

### NEW COMPANIES

**Pure Drug & Chemical Corp.**, New York, to manufacture and distribute drugs and chemicals. It is a subsidiary of United Dye & Chemical Corp.

**Hudson Laboratories, Inc.**, New York, to offer consultation services in chemistry and bacteriology.

**Petrocarb Equipment, Inc.**, New York, to build high temperature equipment and refractory constructions for the process industries including hydro-carbon and certain metallurgical operations.

### NEW REPRESENTATIVES

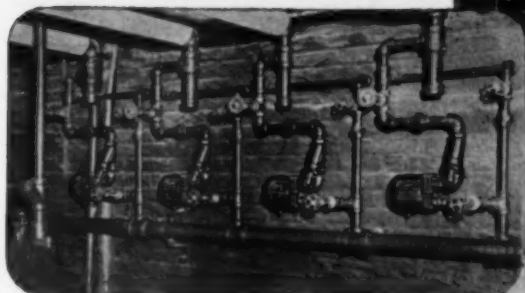
**Northern Equipment Division**, Continental Foundry & Machine Co., Erie, Pa., has appointed Warriner Equipment Co., New Orleans, as district representative for its boiler feed water regulators, differential valves, pump governors and allied equipment.

**Mathieson Chemical Corp.**, Baltimore, has appointed Robert & Co. Associates, Atlanta, Ga., in the person of Harold R. Murdock to handle distribution of its technical information on the application of sodium chlorite and chlorine dioxide to the bleaching of wood pulp as well as the generation of chlorine dioxide from either sodium chlorate or sodium chlorite.

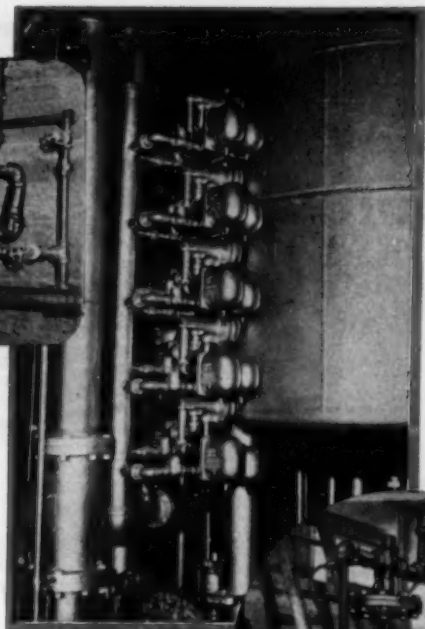
**Automatic Transportation Co.**, Chicago, has appointed John Gilliam  
(Continued)



First we make sure of hot, dry steam at the inlet.



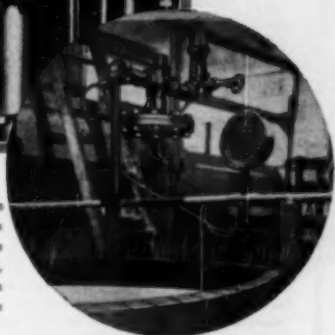
Then we select the best of four distinct types of steam traps to remove all condensate without steam waste.



## GET YOUR STEAM SYSTEM

## *Rationalized* WITH SARCO

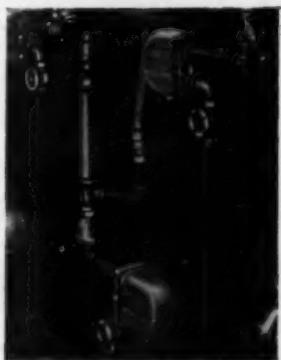
If automatic temperature control is indicated, Sarco can choose from a wide range of self-operated, pilot or electric controls to do the job at minimum cost.



Operating a steam process with maximum efficiency is more than buying a few steam traps and air vents—it is more than haphazardly applying a few temperature controls.

If it means dollars to you in increased production, improved quality and fewer rejects—it will pay you to let the Sarco man near you make a survey of your needs.

He will come up with definite, practical suggestions of how you can do a better job and save steam besides. Write today—there is no obligation.



The new Sarco draining and venting system for dry cans will save at least 20% warm-up time.

307

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# THE NEW WAY TO UNLOAD CARS—SAFER—FASTER



## Stearns Magnetic Clutch Controlled POWER SHOVELS

PATENT PENDING

### SAVES MEN

Using the STEARNS Power Shovel means safer unloading, for the moment the operator releases his pressure on the "dead-man" switch, the scoop stops! Thus injuries resulting from the operator being thrown over the board are eliminated. If the operator's leg is caught in a loop of the cable, serious consequence is avoided as the scoop automatically stops when the safety stop trips the limit switch.

### SAVES TIME

Cars can be unloaded faster with a STEARNS Power Shovel, for the operator does not have to wait for slack cable to be overhauled on short strokes. The scoop can be started or stopped anywhere — less time is spent in cleaning up the car.

### SAVES MONEY

With the control in the hands of the operator, unloading time can be cut up to 30%. This means lower direct labor costs for unloading each car and that more cars can be unloaded each day. As the man in the car completely controls the scoop, labor costs are further reduced — no man is needed outside the car to manipulate weights. Learn how STEARNS Power Shovels can save you men, time and money — write today for specifications and prices.



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#### SAFE

"DEAD-MAN"  
SWITCH  
RELEASE OF  
HAND  
STOPS  
POWER

#### EXTRA SAFE

POWER STOPS WHEN  
SAFETY STOP TRIPS  
LIMIT SWITCH  
SAFETY STOP!

#### STOPS THIS!



#### AND THIS!



#### INDUSTRIAL NOTES, cont. . .

Equipment Co., Dallas, as sales representative for its electric industrial trucks.

Conoflow Corp., Philadelphia, manufacturer of pneumatic control accessory equipment, has appointed J. R. Simpson and Co. as its Chicago representative.

Tube Reducing Corp., Wallington, N. J., has appointed Joseph T. Ryerson & Son, Chicago, exclusive warehouse distributor of its cold drawn tubing.

Hanna Engineering Works, Chicago, manufacturer of air and hydraulic cylinders and controls, has appointed Industrial Air & Hydraulic Equipment Co., Detroit, as its exclusive sales representative in Michigan.

Kieley & Mueller, industrial valve manufacturer of North Bergen, N. J., has appointed Joseph H. Bertram & Co., Boston, as sales representative covering all of New England except Connecticut.

James-Pond-Clark, Pasadena, Calif., has appointed the following distributors for its check valves: Norman Engineering Co., Chicago; Nielsen Hydraulic Equipment Inc., New York; Scott Equipment and Engineering Co., Dayton, Ohio.

General Electric's chemical department in Pittsfield, Mass., has appointed Insulation and Wires, Inc., its distributors in St. Louis, Mo. The agent will handle varnished fabrics, mica products, composite insulation, laminated plastics.

Wheelco Instruments Co., Chicago, has appointed Ansell & Goda, Washington, its district agency for the territory which includes the District of Columbia, Virginia and part of Maryland.

Baker Castor Oil Co., New York, has appointed W. Ronald Benson, Inc., Seattle, its sales agent in Washington and Western Chemicals Inc., Portland, its agents in Oregon.

Hilliard Corp., Elmira, N. Y., manufacturers of lubricating filters, reclaimers and purifiers, has appointed Betz Engineering Sales Co., New Orleans, its representative in Louisiana, Mississippi and southern Arkansas. Allen W. Betz, long active as a sales engineer in the area, heads the New Orleans company.

—End



(chlorine saturated)

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Cost-Saving Performance

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*Acid* **PUMPS**

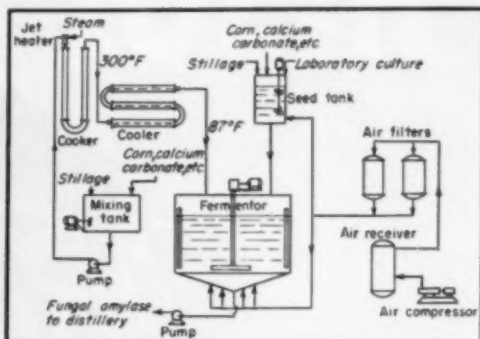
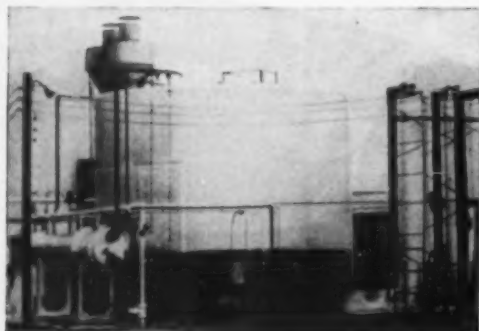
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## Fungal Amylase Process

Fungal amylase is an enzyme that is becoming important. It reduces the high price of grain alcohol by several cents per gallon. It can be used in place of barley malt—costly and in short supply. Manufacture of grain alcohol is largely the same regardless of whether barley malt or fungal amylase is used as the enzyme in converting starch to fermentable sugars. Alcohol produced by the fungal amylase process will not be competitive with that produced by direct synthesis or from blackstrap molasses.

Fungal amylase must be produced by pure culture fermentation. Equipment which must therefore be sterile during the fermentation cycle are the cooker, cooler, fermentor, air filters, seed tank, and pipelines. This equipment is adapted for sterilization by 15-lb. steam. It is arranged so that it can be cleaned easily—so that steam sterilization will be completely effective. Particles of corn could be deposited in the pipe between the air filter and the fermentor for example, becoming centers of infection.

It is possible for infectious material to leak past the gate of a closed valve in a pipe connected to the fermentor or seed tank. For this reason sample outlets, mash inlet lines, drain outlets, etc., are double-valved with a steam seal between the valves.

Air outlets at the top of the fermentor and seed tank are inverted U-shaped to prevent contaminated moisture and dust from getting into these openings.

### PROCESS

First of all, solids content of the stillage is upped from about 4 to 6-8

percent by addition of evaporated stillage (distiller's sirup). Other mix tank ingredients are added to give a medium of 1 percent corn and 0.25-0.50 percent calcium carbonate at a pH of 5.0-5.5. A small amount of ammonium bifluoride inhibits bacterial growth. A typical plant run: 25,000 gal. medium containing 2,000 lb. ground corn, 1,000 lb. calcium carbonate, 325 lb. sodium hydroxide, and 37 lb. ammonium bifluoride.

Medium passes continuously through the cooker where it is immediately heated to 290 deg. F. by mixing with a jet of 55 psi. steam. After 6 min. in the cooker, the medium goes to the cooler via an expansion valve, and enters the fermentor at 87 deg. F. A run of 25,000 gal. takes about 12 hr. for this sterilization operation.

Approximately 250 gal. of fortified thin stillage is used in seed preparation. This volume is brought up to about 260 gal. by the addition of 20 lb. corn, 7.5 lb. calcium carbonate, 140 grams ammonium bifluoride, and 2.0 lb. sodium hydroxide (typical amounts). Composition of medium before sterilization: 0.92, 0.35, and 0.014 percent in order named, and the pH after sterilization: 5.6.

The seed medium is sterilized by cooking with open steam 60 min. at 240 deg. F., cooling to 90-100 deg. F., holding at this temperature for several hours, and recooling for 60 min. at 270 deg. F. Then it is cooled to 87 deg. F., and inoculated with 10 liters of a laboratory culture of *Aspergillus niger*.

Inoculation of the seed lasts for 24-30 hr. while the temperature is kept at 84-88 deg. F. Sterile air is supplied

during inoculation at a rate of 1 volume per volume of medium per minute.

Transfer of seed to the large fermentor is done by closing the vent and upping the air pressure to 12-15 psig. The large fermentor is inoculated with the seed while it is being charged with the main medium.

Pure culture fermentation is aided when the pressure inside the vessel is slightly greater than atmospheric. So aeration of the large fermentor is begun immediately after steaming and just before sterile medium is pumped into the tank. It is carried out at 650-950 cfm. corresponding to 0.2-0.28 volumes of air per volume of medium per minute (for 25,000 gal. in tank). Temperature in the large fermentor is usually kept at 85-89 deg. F., with the aid of cold water and warm condensate sprays on the outside of the vessel. Fungal amylase liquor is ready for use after 48-60 hr. It is then pumped to the distillery as needed in the mashing operations for making grain alcohol.

The process was developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. Commercial-scale experimental units for the production of fungal amylase and grain alcohol using fungal amylase have recently been installed at the plant of the Grain Processing Corp., Muscatine, Iowa. The fungal amylase production process as it is operated at this plant is described here.

From Technical Bulletin No. 1024, U. S. Department of Agriculture.

(Continued)

# A FORWARD STEP—

IN CHLORINE AND CAUSTIC SODA PRODUCTION

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- ★ Accurate anode adjustment—uniform cell voltage
- ★ Simple brine system
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- ★ Complete "turnkey" plants

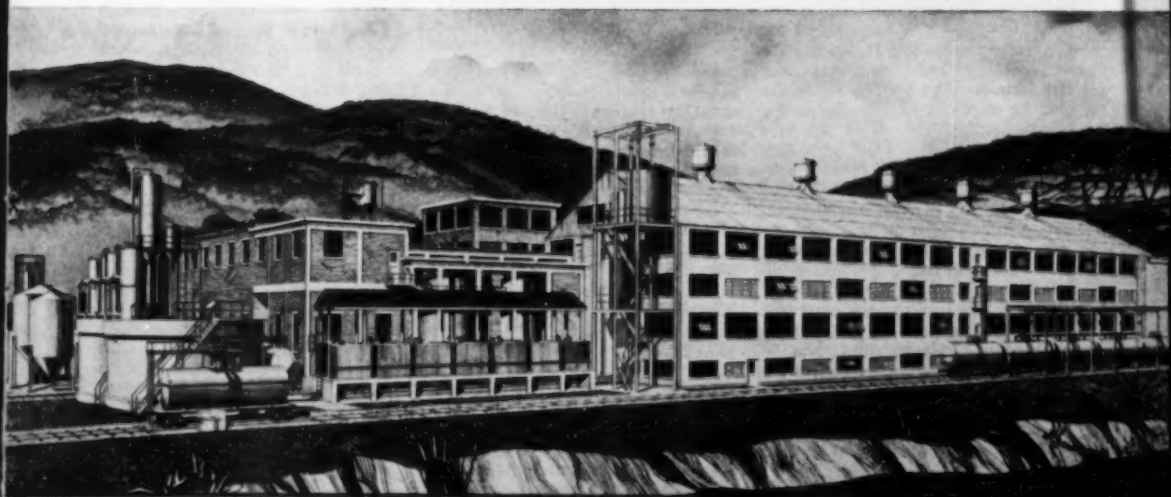


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## CHEMICAL PLANTS DIVISION

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*Drawing of a Mathieson Mercury Cell Plant now under construction*



## Can Uranium Compete With Coal?

Assume: 4.5 Mills per Kwh.  
400,000 Kw. Output

OTHER ASSUMPTIONS: 6% interest; 2% taxes; 2% depreciation on conventional equipment, 10% on nuclear equipment. Also: Fixed charges on site, generators, switchgear and transformers at 11% per yr. on \$21.6 million; and 11% per yr. on \$18.4 million on coal-fired boiler.

Mills per kwh. for fuel will be.....	2.0	2.0	0.0	0.0
for operation.....	1.0	1.0	1.0	1.0
for byproduct credit.....	0.0	0.0	0.0	-2.0
for fixed charges (excluding boiler).....	0.8	0.8	0.8	0.8
If fixed charges on coal-fired boiler are.....	0.7	.....	.....	.....
allowable fixed charges on nuclear-fueled boiler to give equivalent production cost will be.....	.....	0.7	2.7	4.7
to give identical power costs totals.....	4.5	4.5	4.5	4.5
This makes the amount available to spend (at 18% per yr. fixed charges) for nuclear-fueled boilers, millions of dollars.....		\$11.1	\$38.3	\$65.5
but such a boiler would probably cost.....		\$50-\$100 million		
So can nuclear power compete?.....		No	No	Maybe

### Power Plants

Coal	Nuclear		
	"A"	"B"	"C"
Coal-Fired; Steam Turbine	Fuel Cost Same as for Coal	Fuel Cost Negligible	No Fuel Cost; Byproduct Credit
	2.0	0.0	0.0
	1.0	1.0	1.0
	0.0	0.0	-2.0
	0.8	0.8	0.8
	0.7	.....	.....
	.....	0.7	2.7
	4.5	4.5	4.5
		\$11.1	\$38.3
		\$50-\$100 million	\$65.5
		No	No
		No	Maybe

## Nuclear Power Isn't Cheap—Yet

C. G. Suits

There are several hypothetical reactors worth considering in an appraisal of nuclear power. Let's first consider a typical 400,000-kw. steam-electric plant as a suitable base to which these hypothetical reactor may be referred.

This typical steam-electric plant produces power at a cost of 4.5 mills per kwh. This is broken down into 1.5 mills for fixed charges (0.7 of this for the boiler itself), 2 for fuel, and 1 for operation. The total construction cost is \$40,000,000, with \$18,400,000 for the boiler plant and \$21,600,000 for site, generator plant, switchgear, and transformers. The boiler plant is the unit for which we would substitute a nuclear reactor.

### HYPOTHETICAL NUCLEAR REACTOR "A"

Here we are assuming the cost of nuclear fuel on a heat basis equal to coal, operating costs the same, and nuclear byproducts not worth reclaiming or if reclaimed, cost of processing offsets their value.

To produce power at the same cost of 4.5 mills per kwh., the fixed charges on the nuclear boiler must then be the same, since the fuel and operating costs are the same. The fixed charges total 11 percent of the investment. For the boiler, they amount to \$2,000,000 per year (11 percent of \$18,400,000).

Increased depreciation on a nuclear boiler raises its fixed charges to 18 percent. These fixed charges can support a nuclear boiler investment of no more than \$11,100,000. Since a nuclear boiler of the same capacity as our typical steam-electric plant under present limitations of technology might cost \$50-100,000,000, this first hypothetical nuclear reactor would come far from producing competitive power.

### HYPOTHETICAL NUCLEAR REACTOR "B"

For this boiler, the assumptions are the same except that the cost of nuclear fuel per heat unit is assumed negligible. This might be the case in a reactor in which native uranium would be "burned" until exhausted and then thrown away, or when the spent reactor fuel could be sold for a value equal to its cost.

Under these circumstances, the 2.0 mills charged to fuel can be allocated to boiler fixed charges, raising them from 0.7 to 2.7 mills per kwh. This will support an investment of \$38,300,000, still not enough for competitive power.

### HYPOTHETICAL NUCLEAR REACTOR "C"

This case includes a combination of favorable circumstances which might develop. The new assumption is an

efficient breeding cycle, where spent nuclear fuel is sold for its plutonium content and credited against the power production at a rate of 2 mills per kwh.

Here we can jump the boiler fixed charges to 4.7 mills/kwh., which will support an investment of \$65,500,000. It is possible that this boiler would produce competitive power.

### FUTURE POSSIBILITIES

A substantial improvement must be expected from continuing research and development.

Also, the economic baseline used in this discussion is not the most favorable. A combination of high fuel and transportation costs coupled to the requirement for large blocks of power would considerably enhance the case for nuclear power plants.

C. G. Suits, General Electric Co., before the American Association for the Advancement of Science, Cleveland, Dec. 29, 1950.

## MACHINE DESIGN

### ... Corrected for operators

Now machine designers have a handbook of data on the human operators of their machines. Often the most powerful machine must wait for the operator to read dials, or it is damaged because he cannot understand warning signals. These limitations became particularly clear during World War II, and many experimental programs were launched to find out just what human capacities are and how new devices can best be designed to fit them. Now the results of these programs and many others have been combined into a massive "Handbook of Human Engineering Data for Design Engineers," which is available through the Institute of Applied Experimental Psychology of Tufts College, which prepared the compendium for the Office of Naval Research.

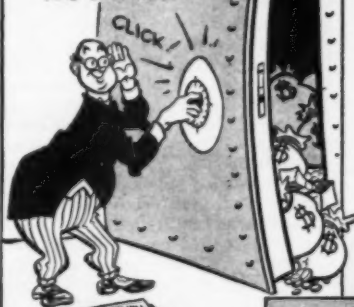
The new handbook gives a wealth of data on such influential factors as body size, vision, hearing, and the effects of motion, incentives, fatigue, temperature and humidity, and stimulants. Besides well defined data, the book includes general discussions of such subjects as vision, hearing, and intelligence, as well as extensive bibliographies and some solutions to past design problems.

Although many of the problems arose from military needs, much of the information can be applied to industrial situations. Indeed, this "human engineering" approach is an extension of the long established industrial engineering studies of time and (Continued)

# FACTS about READERSHIP from THE A.R.F. STUDY OF CHEMICAL ENGINEERING

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QED, cont. . .

motion sequences in machine operations.

It was also found that red light allows the eye to adapt to the dark much more quickly than white or other colors. Navy personnel wearing red goggles for dark adaptation avoided having to stay in a darkened room before going on watch. It takes about 30 min. for the light-adapted eye to increase in sensitivity 15,000 times to become fully dark adapted, but only 2 min. when red goggles are worn for 45 min. beforehand. When red lights were used to illuminate indicators and charts, no impairment of night vision occurred. Similarly, red light for automobile instrument panels would make less demand on the driver, as he shifted his gaze from the instruments to the road ahead, than would the common green lighting.

Although a tremendous store of knowledge has been accumulated by illumination engineers over a number of years, the handbook points out that the proper intensity of illumination is only one aspect of the problem. Also important are such factors as the colors in the light, the degree of diffusion, colors of objects in the surroundings, glare and shadows, contrast, and the ratio of brightness of the work area to its surroundings.

Other vision tests revealed that the driver of a car can perceive unexpected objects only about half as far away as the expected ones. Although the perception distance increases rapidly for the first few thousand candlepower in the headlights, it increases more slowly thereafter; the driver of a car travelling at 50 mph. with 20,000 cp. headlights sees ahead about 75 ft. less than the distance required for stopping.

Another series of tests showed that glare significantly increases muscular tension, sometimes as much as 30 percent. Although visual tasks may be carried on under severe handicaps with no immediate loss in accuracy over a long period of time a decrease in efficiency accompanies nervous muscular tension.

The actual energy required to type under the noise conditions usually encountered in a busy office has been measured by basal metabolism tests. When plaster walls were left bare to reflect noise, the typists showed a metabolic rate 71 percent above the resting level; when the walls were covered with a sound-deadening material to absorb about half the noise, the metabolic rate was only 52 percent above the resting level, and there was a 43 percent increase in typing speed. In an experiment in a weaving room, the workers' speed increased about 12

percent when they were wearing ear protectors. There is some evidence that even after years of work in noisy surroundings, workers do not become completely adapted to the noise but have to adjust themselves daily.

Many of the data in the handbook concerns the effect of physical variations in the environment on work performance. Many industrial situations involve environmental problems of heat, humidity, or noxious gases. It was found, for instance, that, within the temperature limits which bring on stupor, lowered performance was due more to boredom or lack of incentive than to the physical conditions. Fatigue or broken sleep reduces performance in some tests, but has surprisingly little effect in others. Also covered in the handbook are a variety of subjects not usually connected directly with production, such as readability of type (Garamond can be read most quickly, but readers like Cheltenham best), and the physiological effects of tobacco, alcohol, caffeine, and benzedrine.

From the January 1951 issue of the Industrial Bulletin of A. D. Little, Inc.

## GRINDING BALL MILLS

### ... Slow 'Em Down, Save Money

Harlowe Hardinge, R. C. Ferguson

You may not have thought so, but operating ball mills at slower speeds may save you many dollars in power and ball costs. Recent studies have put forth the following conclusions:

1. Grinding efficiency increases as mill speed decreases within the range of practical operation.

2. Both power and ball cost per ton of -200 mesh produced, decreases with a decrease of mill speed.

3. A slow speed, high pulp-level mill, with sufficient additional volume to equal the capacity of an equivalent higher speed mill, will make up the difference in capital cost between the two mills in well under a year's operating time through the savings in power and ball costs alone.

4. If an existing high pulp-level mill operating at "normal" speed is replaced by a new, but larger, lower speed mill of the same capacity, the new mill can pay for itself in less than two years' time out of the savings in power and ball cost alone. Only a very moderate resale value for the old mill is assumed in this case.

5. If an existing high pulp-level mill is replaced by a slow speed larger mill, an increase of 20 to 25 percent in capacity is possible without increasing

(Continued)

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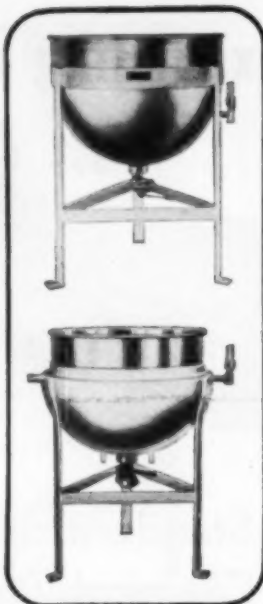
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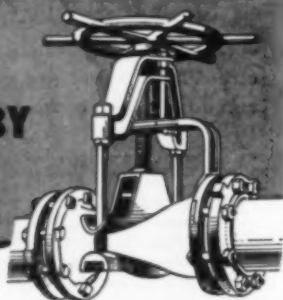
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*QED, cont. . .*

the power consumption or cost of operation. If the decrease in operating cost per ton is also capitalized, this decrease alone will pay for the new mill in less than three years' time.

From *Mining Engineering*, Nov. 1950, pp. 1127-1130.

## NUCLEAR ENGINEERING?

*. . . Not Yet*

B. W. Bartlett

At this stage in the development of the applications of nuclear energy, the establishment of a new branch of engineering called nuclear engineering is neither necessary nor desirable. Until such time as nuclear power plants become a standardized method of producing commercial power in the same fashion that hydroelectric plants or steam power plants produce commercial power there is no particular place for the nuclear engineer. The potential applications of nuclear energy in the interests of mankind are too broad and as yet too undeveloped for it to be the part of wisdom to segregate this area of science in a single compartment.

Experimentation, which must be carried on over a period of many years, perhaps even decades before that time comes, must be conducted primarily by nuclear physicists and chemists. They will utilize the services of competent metallurgical, chemical, civil, mechanical and electrical engineers to assist them in the design and construction of these pilot plants. Such individuals, the engineering members of the team, need not be specialists in nuclear physics. Their training should be that of the conventional or classical type of engineer with the addition of a survey course, in nuclear physics, of sufficient scope to make them aware of the special nature of reactor materials and radioactive fission products. Such a course should be required in all the major conventional branches of engineering.

Institution of such a requirement, in addition to its professional usefulness to the young engineering graduate, would at the same time serve the interests of national security in that it would spread among the entire population a substantial leaven of responsible persons with the engineering attitude who knew the truth about nuclear radiation hazards, thereby assisting in the proper indoctrination of the general public with the type of knowledge about atomic energy which would be needed in the event of atomic attack upon the United States. There is evidence that nuclear physi-



cists and chemists, particularly the former, are in short supply. Members of engineering school faculties should be on the alert to identify potential candidates for doctoral training in this field and to encourage them to undertake it. Finally, administrative officers of the engineering schools should seriously consider increasing their facilities for teaching engineering physics. This discipline is the most promising one as a source of personnel for the subsidiary fields of nuclear engineering, nuclear instrumentation, and health physics. Opportunities for engineering physicists are bound to increase during the next decade. Administrative officers concerned with the guidance of young engineering students should consider turning larger and larger numbers of them into this field of engineering by proper student counseling.

Col. B. W. Bartlett, U. S. Military Academy, before the American Association for the Advancement of Science, Cleveland, Dec. 28, 1950.

## MECHANICAL EQUIPMENT

... Is Available, But

D. A. Comes

In discussing the availability of mechanical equipment, it is necessary to be rather vague as the world situation has a great deal to do with the delivery situation. At present we are quoting 7 to 8 mo. delivery on machinery and the same approximate delivery holds good for electrical equipment.

We are supplying and believe we can continue to supply Banbury mixers, plastic mills, plastic calendars—both of the Z and inverted L type, and screw machines for the plastics industry. It is possible we may have to substitute certain materials for ones that we are now supplying.

We use a great deal of stellite which has a 50 percent cobalt content. Cobalt is one of the major materials used for high temperature alloys for jet engines. It is also used for electronic equipment. Nickel is another material becoming hard to get and we use it in a number of ways. Aluminum comes under the same heading but plans are already made, in case of shortages, to make substitutions.

On steel plate and pig iron the situation is not too bad and we believe we

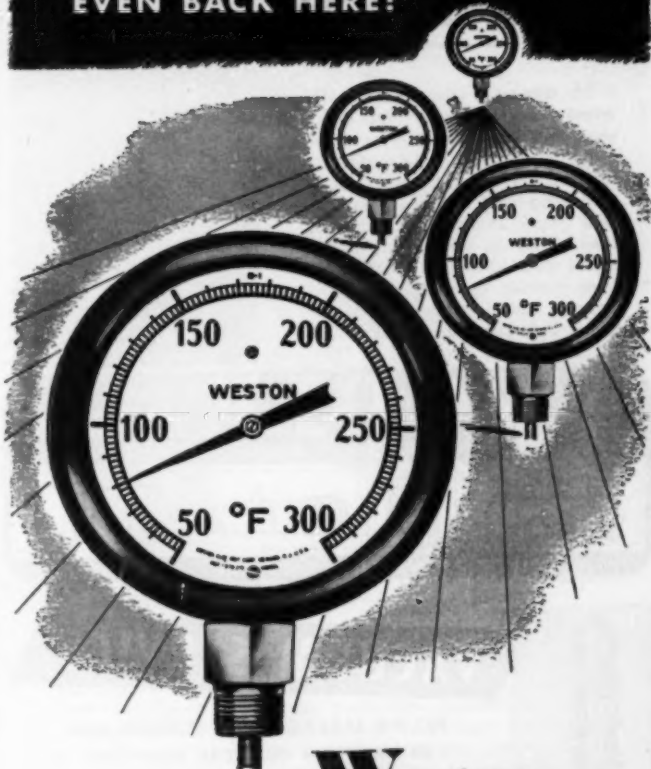
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## CHAIN REACTION AT THE MINT

"A structure to handle radioactive materials would cost 51 times as much as a pre-nuclear energy twin."

J. N. STANNARD  
University of Rochester

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Seconds count when things go wrong . . . wherever temperatures are critical. And not even a split-second is lost in reading temperatures accurately, when the thermometers are WESTON. Their large, boldly marked faces are readable, even from a distance. And the rugged, all-metal construction of WESTON bi-metal thermometers assures dependable, trouble-free operation. Available in types, sizes and stem lengths for most industrial applications. Write for bulletin T-13. Weston Electrical Instrument Corporation, 583 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue Instruments.

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QED, cont. . .

will be able to obtain enough for our needs.

At present it is very doubtful if any DO orders will be used for plastics machinery. However, the material in our planned substitutions is almost as good as the material that is being replaced.

I believe the plastics industry can definitely count on obtaining new equipment if they desire. The only advice I can give is do not place any orders for equipment unless you really want it as the chances are 999 out of 1,000 you will get it.

D. A. Comes, Farrel-Birmingham Co., before the Society of the Plastics Industry, New York, Dec. 14, 1950.

**LUBRICATION**

. . . **Chemicals and Textiles**

Ted R. Witt

The maintenance department at Tennessee Eastman Corp. maintains both the chemical and textile equipment used in the manufacture of cellulose acetate yarns. The equipment operates twenty-four hours a day, seven days a week and consists essentially of conveyors, dissolvers, blenders, pumps of many types and sizes, filtration equipment, spinning, twisting and winding machinery. The number of individual bearings to be lubricated in a large installation of this kind runs into the thousands. In one department alone there are approximately 60,000 anti-friction bearings in operation. There are thousands of high speed spindles. According to a survey conducted by one of the large electric companies, the textile industry ranks first in the use of electric motors. Approximately 4,000 motors, most of which are the ball bearing type, are used to drive this machinery. The lubrication of this number of moving parts, to be done economically and with a minimum of machine down time, is a job that is not to be placed second in importance to any other item of maintenance.

Realizing that the men lubricating the equipment are in a good position to know of incipient failures and to help measure the effectiveness of the lubricant, we have organized a group of men under a foreman whose sole job is the lubrication of all of the equipment. This group is given talks to teach them the points about lubricants and lubrication that we feel they are capable of understanding. This includes the simple mechanics of lubrication and the principles of the machines that they lubricate. This has created job interest in the men and given them a sense of importance.

They are encouraged to make suggestions as to changes in lubricants, devices, or scheduling, but prohibited from making individual experiments. Only by the rigid adherence to the established lubrication practice can one tell at the end of a few years whether or not the schedule is adequate.

One of the factors to be considered in organizing an economical plant lubrication program is the number of lubricants to be carried in stock. Several years ago we set-up a lubrication committee consisting of maintenance men from all the divisions of the plant with representatives from the purchasing and engineering departments. The plant lubrication engineer is chairman. It was found that 57 different lubricants were being carried in stock. The work of this committee has brought this number down to eight oils and three greases. The committee meets once each quarter and a great deal of benefit has been derived from the committee meetings by the exchange of information and experience regarding lubrication problems all over the plant.

Several papers on plant lubrication recently have criticized maintenance people for the way some plant lubrication is conducted. It is recognized that any plant that is operating is being lubricated, but the people who know lubrication feel that in most cases a better and more economical job can be done. In my opinion this can be accomplished by greater cooperation between plant maintenance men and the plant lubrication engineer as well as cooperation by the plant lubrication engineer with lubricating experts of the oil companies.

Ted R. Witt, Tennessee Eastman Corp., before the plant maintenance conf., Cleveland, Jan. 17, 1951.

## PUBLIC RELATIONS

### ... A Newspaperman's View

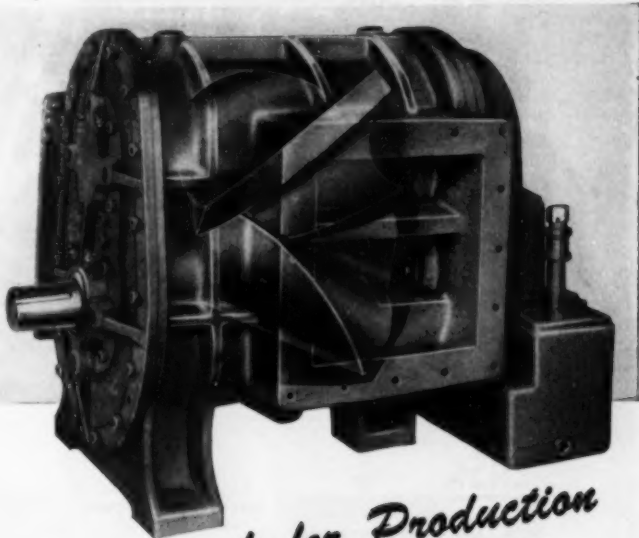
Dwight Moody

Amazing is the number of top management officials who appear totally unaware of the importance of public understanding of their company and their industry. Many have been so wrapped up in developing their production and sales that they have become blind to the social and economic and political changes that chemistry has helped to bring about in the last 50 years.

The very growth of the chemical industry and some individual units has made them particularly vulnerable to political attack. A popular target of abuse by the demagogic type of politician, in appeals to what he calls the

(Continued)

# The STANDARDAIRE Axial Flow BLOWER ~



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To meet the increasing demand for Standardaire Blowers our manufacturing facilities have progressed from custom built techniques to precision production methods for the principal components of the blower. In addition to other improvements, new manufacturing processes and equipment are now being used to generate the cycloidal form, screw type main and gate rotors on a production basis without sacrificing precision and accuracy of fit—important details in maintaining the "air screw" action feature of the Standardaire Blower.

Through this unique achievement in production engineering it is possible for Standard Stoker to offer industry a Standardaire Blower with the design features and efficiency of a custom built job at the availability of a quantity production unit.

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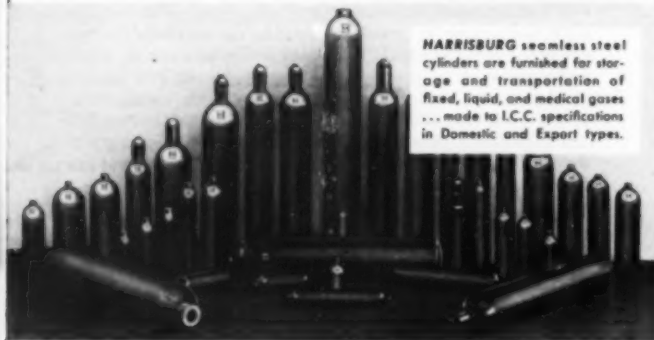
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QED, cont. . .

"little people," is a business that is big. So long as there is lacking public understanding of the important contribution of a company or an industry to our national life there is constant danger of punitive legislation.

A while back, when I was visiting in a distant city, I called on an important chemical processing company—to cite one case of a number that might be mentioned. The president of this company greeted me cordially, and with justifiable pride showed me about his plant, to indicate the contrast with a picture of the original plant. He also told me of products this his company had developed and made available to benefit the American people, including a new product just about to be introduced.

When I pointed out that this development was newsworthy, this company president hastened to explain that his company never had believed in publicity. They advertised their products in some medical journals and kept doctors informed on their products—that was about all. It was a tradition!

Other people I talked with in this same city knew that there was a chemical plant of that name in their community, but were vague about what it produced and gave the impression they didn't consider the plant anything for the city to brag about. People here in New York, outside this particular segment of the industry, had never even heard the name of the company, let alone knowing of its important contributions to human welfare.

I couldn't help but recall two companies in another city, whose managements I knew well over a considerable period of time. One company was founded around the turn of the century, provided a valuable service to the community, was managed efficiently and eventually absorbed several less efficient competitors and became a relatively large company. Neither the founder of the company, nor his successor, who was trained in the same school, believed in telling the public anything about their operations.

When the company became a popular target for political attack, the management finally bowed to the increasing demands of minority stockholders for new policies, and established a public relations department but the appropriation was so completely inadequate for the job to be done that it was like throwing money down the drain. This company no longer is in existence—it was killed by a special act of legislature.

Having offices in the same building



was an even larger company, in a similar line of business. Some years earlier this company had adopted a sound program of public relations. Today this second company is bigger than ever, and still growing.

Were the chemical industry to do half as good a job in educating the public on the importance of the industry and its contributions to public welfare, as it has done in research, production and sales during the past 50 years, I firmly believe the future for the industry would be much less difficult.

Dwight Moody, N. Y. Journal of Commerce, before the Synthetic Organic Chemical Manufacturers Assn., New York, Jan. 10, 1951.

## LUBRICATION

### . . . 3 Broad Phases

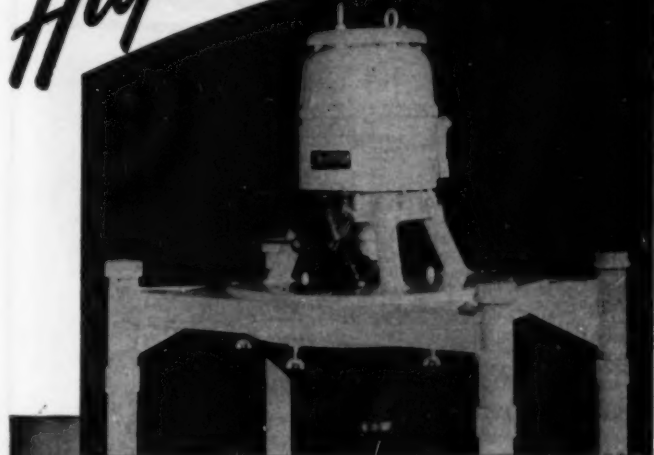
D. F. Hollingsworth

The primary reason for lubrication of any machine is to limit heat, wear, and rust where metals are in motion. It makes no difference what industry is considered. It is rare that the manufacturing process exists where lubricated parts are unnecessary. The process may differ and the equipment design may vary, but, fundamentally, the machines are only a mechanical arrangement of elements that don't know whether they are functioning on a mill in a steel plant or a kiln in a chemical plant. What then, is the difference in the lubrication of a chemical plant from that of any other industry? The answer is that there is little or no difference in the machines but there may be quite a difference in the ambient operating conditions.

In the chemical industry, the range in the manufacture of a single product, such as a synthetic fiber, extends from enormous compressors to tiny, high-speed spindles. For instance, the compressor may operate at low pressure or at pressures of several thousand pounds. It may be handling a gas that is wet or dry, corrosive or non-corrosive, clean or dirty, hot or cold, or a combination of these conditions. The manufactured product may attack the lubricant or the lubricant, in turn, may retard the chemical reaction or contaminate the finished product. Lubrication in the chemical industry requires that the lubrication engineer have a broad knowledge of the manufacturing process and its equipment, together with a detailed understanding of the lubricants he uses and how to effectively apply them. In addition to the normal mechanical problems, the operating conditions and process must always be considered.

It has been proved that proper lubrication  
(Continued)

# High Speed Mixer



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• The "ENTOLETER" Mixer requires only 12 cu. ft., with capacity of 12,000 lbs. of finished mix per hour. This equipment destroys all stages of insect life where beetle or similar insect infestation may be present. Mail coupon today for full description.

Homogeneous mixing is now obtainable for chemical products in faster time . . . at less cost . . . with the "ENTOLETER" High Speed Mixer. Amazing savings have been effected in processing time. One company has been able to reduce its mixing cycle from 2 hours to ½ hour. The saving in mixing time is usually accompanied by a smoother, more intimate mix, permitting improvement in product quality. The high-speed centrifugal action thoroughly disperses materials, producing a remarkably smooth textured product.

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EST. 1923

QED, cont. . .

rication can accomplish as much toward preventive maintenance as all factors put together. The progressive chemical manufacturer knows that to produce the goods he must spend money on lubrication and keep it under control. He is vitally interested in it from two standpoints: first, as an essential key to continuous operation, and second, the cost, which must not be taken lightly.

The lubrication field in the chemical industry, as well as any other, naturally divides itself into three broad phases, each to be performed with due regard to economy.

1. Machines must be designed for adequate lubrication and for the proper application of lubricants.

2. The proper lubricant must be purchased and suitable inventories maintained where needed.

3. The correct lubricant must be delivered at the proper time and in proper quantity to the particular spot at each machine throughout the manufacturing area.

First, the design of equipment for adequate lubrication is profoundly influenced by the competitive nature of our economy. As an example, the manufacturer of the electric refrigerator in our kitchens knows that it is unrealistic to expect the ladies to pay any attention to its oil. So he builds in sufficient lubrication to last the life of the machine. At the other extreme is the highly specialized equipment used by the chemical industry. Lubrication is unlikely to be recognized as the cause of failure of many types of chemical process equipment. So the purchaser needs to have engineers to study the machinery to make sure there is suitable provision for lubrication.

Second, the purchasing of lubricants, specifying the correct grades, and making the right quantity available where and when needed is in itself a major field. There are at least three distinct steps in the purchasing of lubricants.

1. There should be an evaluation of the lubricants necessary for each machine to be operated, together with an estimate of annual consumption.

2. Requirements should be consolidated so that a minimum number of lubricants may be kept on hand.

3. A guide should be established for the purchasing agent to make sure that purchases conform to requirements.

It is necessary that the engineer and purchasing agent cooperate to keep things under control. We are all aware of what excess inventory stock will do to a business. Lubricants are no exception.

**1 TO 68 THEN  
68 TO 1 WHEN?**

"In 1910 one working adult out of 68 was employed in a local, state or federal government job. Today one working adult in 10 is so employed and most of the increase has come in federal employees."

REESE H. TAYLOR, *President  
Union Oil Co. of California*

A few years ago, a large plant about to go into operation was found to have on hand 900 drums and 80 different varieties of lubricants. Included were a dozen barrels of elevator guide rail grease—enough to run the two elevators in the plant for years. A lubrication engineer subsequently specified a dozen types which would meet all needs. He cut the inventory to one-sixth its original size.

The third major lubrication activity is application. This means simply to get the right lubricant to the right bearing in proper quantities at the right time with the least cost. Failure to do so will mean a breakdown of the sequence of steps which a product goes through in the manufacturing process. The failure of a single link in the chain may curtail production by many tons.

D. F. Hollingsworth, E. I. du Pont de Nemours & Co., before the Plant Maintenance Conf., Cleveland, Jan. 17, 1951.

## ACOUSTICS

### ... Halting Machinery Noise

Howard C. Hardy

Acoustical engineers are using noise circuits similar to electrical circuits to track down the sources of machinery noise.

Just as in a violin, the source of sound is the slipping action of the bow on the string, but the radiating surface is the body of the violin, in the same manner, a noise engineer must be careful to distinguish between the source of sound energy and the sources of radiated sound.

Once noise engineers have made diagrams of all noise energy paths in a machine, they can reduce the sources of sound or disconnect the circuit at some point.

We call the breaking of a noise circuit "de-coupling." The spring mountings used on car engines are an example. The engine shakes, but not the car itself. There is just as much energy, but less noise.

Sometimes an experienced research worker in noise reduction can quickly recognize the trouble. More often,

(Continued)

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**Where can they be applied**—to any size and shape of bin, hopper and chute—whether made of steel, wood or concrete.

**How are they applied**—thickness or gauge of wall is the most important factor. However, over-all dimensions, cubic content, degree of fineness and moisture content of material must also be considered.

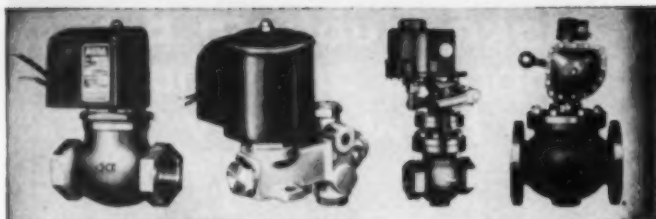
With giving the details of your troublesome bin or hopper—our Engineering Department will be glad to give you their recommendations.

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## Ideal *Automatic* Control for Liquid or Gas Flow!

You can't beat the solenoid operated valve for many conditions where the flow of a liquid or gas must be automatically controlled. And the meaning of "controlled" covers quite a range of services. For example, in the line of ASCO Solenoid Valves you can get automatic control through the following, each functioning differently.

- Safety Shut-off and Trip Valves
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- Shut-off Valves—Pachless Type
- 3-Way Pilot Valves
- 2-Way & 3-Way Pilot Controlled Valves
- 4-Way Pilot Valves

Everyone of these valves functions automatically either in an emergency or in timed

cycles, depending upon the design and application. Some reset manually; others, electrically. They are designed for use on pipe lines conveying liquids or gases or on processing machinery which must be protected by an automatic flow control or which requires automatic timing of the flow in its operation. We suggest that if some type of automatic control of liquid or gas flow is required in your plant, you investigate ASCO Solenoid Valves. They are constructed to meet many corrosive conditions and many have explosion-proof and water-proof solenoids. Many, too, are of the design approved by Factory Mutuals and Underwriters' Laboratories.

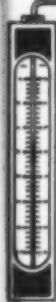
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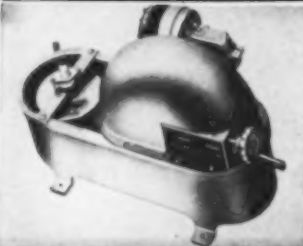
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QED, cont. . .

however, noise reduction comes about by careful scientific analysis, good measurements, and keen engineering insight by a team of experienced workers.

Finding the original sound source in a machine is often complicated by the fact that there are secondary sources between the energy source and the radiating surface. The noises follow devious paths, all requiring careful analysis.

By making schematic diagrams on which are plotted the paths that noise energy takes between its source and radiation point, the relative influence of each path can be evaluated and the simplest and most inexpensive method determined to produce results.

Howard C. Hardy, Illinois Institute of Technology, before the National Noise Abatement Symposium, Chicago, Oct. 20, 1950.

## MANGANESE RECOVERY

. . . From domestic ores

E. S. Nossen

An economical method of refining domestic manganese ore which, if properly exploited, might make America independent of foreign sources for more than 100 years was recently described.

The process involves converting manganese ores to manganese monoxide and then dissolving the material in nitric acid. The nitric acid cycle permits the acid to be recovered and reused, thus making economical operation possible.

Process is applicable to both oxide and carbonate ores, the two kinds most prevalent in this country. It appears to be very advantageous in ores with a high iron content such as those of the Cujuna range in Minnesota, because a large amount of the iron is recovered.

The major steps of the process are very simple ones and do not require any complicated or unusual operating conditions such as high pressures and high temperatures. Gas reactions, usually leading to large losses of valuable reagents and making the reaction steps interdependent, are avoided.

Necessary equipment consists of standard equipment such as that used in mining, metallurgical and chemical operations.

It is known that hundreds of millions of tons of manganese-containing ores are available in the United States.

E. S. Nossen, Nossen Laboratories Inc., before the North Jersey Section, American Chemical Society, Newark, Jan. 9, 1951.

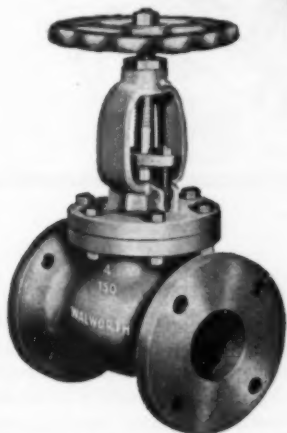
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Made of Stainless Steel  
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Walworth offers a comprehensive line of valves made of several cast stainless steels and special alloys for piping services where corrosion is a factor. These valves are available in Gate, Globe, Angle, Check, and Lubricated Plug types.

Gate, Globe and Angle Valves have outside screw and yoke construction, thus keeping the stem threads out of contact with the corrosive material in the line. They also have a two-piece bolted gland with ball-type gland follower to prevent binding the stem when packing bolts are tightened. Gland eye-bolts can be conveniently swung out of the way without danger of loss when the gland is lifted for repacking.

Gate Valves have taper seats with a unit consisting of two flat faced discs supported by a carrier on the end of the stem. The discs are of a proven ball-and-socket type. They are free to rotate and adjust themselves to the body seat angles, assuring tight seating with no possibility of sticking in any position.

For further information about Walworth's full line of corrosion-resistant valves, see your Walworth distributor.



Sectional view of Walworth  
300-pound Stainless Steel  
Gate Valve ... available in  
sizes 2 to 6-inch, flanged.

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"Start out with the right materials properly applied...and dividends from your insulation investment will be never ending."



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**YOU GET THE RIGHT MATERIALS —** Regardless of the service conditions on your job, Johns-Manville has an insulation that fits the need. That's because Johns-Manville manufactures a wide variety of insulations of asbestos and other selected raw materials—for service from -400F below zero to 3000F above. Johns-Manville offers this complete line because industry requires many types of insulations and because no one material can properly serve as a jack-of-all trades for use on all jobs.

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Why not call on insulation headquarters for engineering advice about your insulation work. J-M Insulation Engineers are available to help select the *right* insulation for your particular service conditions. Write Johns-Manville, Box 290, New York 16, N.Y.



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**INSULATIONS**

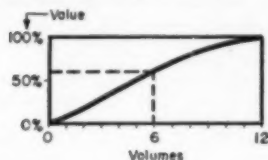


## Your ECT Is Half Finished

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. Vol. 6: Explosives to Furfural. Edited by Raymond E. Kirk and Donald F. Othmer. Assistant editors: Janet D. Scott and Anthony Standen. Interscience Encyclopedia, New York. 1,008 pages. \$20.

Half way. That's where we are. Half way to getting the complete 12-volume set of Kirk-Othmer-Scott-Standen's "Encyclopedia of Chemical Technology." With the appearance of Vol. 6 last month, the hard-working editors have gotten 50 percent of their production quota filled.

I've already told you how the value of ECT increases non-linearly. This is because of cross referencing. Six volumes are worth more than six times one volume. Perhaps the usefulness increases something like this:



If this is correct, we have 50 percent of the books and about 60 percent

of the value. And only 23 percent of the alphabet. (With the publication of Vol. 7 next summer these percentages will be 58, 70 and 46 respectively.)

Now that we've established comparative worth, let's look at some of the details of Vol. 6. Here are some of my impressions:

**The Best Section:** Probably the discussion of fluorine and its compounds (inorganic & organic) rates this distinction. It is very long and has many authors. Its length is justified, surely, by timeliness and importance. The number of contributors tends to increase our feeling of accuracy and reliability.

**Runners Up:** There are two sections mighty close behind Fluorine. Explosives and Fertilizers are both fine and are both good survey types of articles. They are not quite as timely as F, and lots more has been published on them. So they don't appear to rate the space or interest that fluorine is currently enjoying.

**Longest:** Nosing out Fluorine by a few pages is the section on Fatty Acids. There are reams and reams of published material on these. Even after the ECT editors got through their drastic cutting, the entry runs to better than

12 percent of the book's total length. No matter how far you want to go into the subject, you will probably find the answer here—if anywhere. And if you don't, the bibliographies will guide you.

**Shortest:** "Farina—See Cereals."

**Best Writing:** In a book like this it's tough to preserve a smoothness of presentation. There are more authors than there are main entries. It is a credit to the editors that everything reads as well as it does. It is purely opinion, but I believe the story of Felt reads as well or better than any other in Vol. 6.

**Poorest Writing:** I think I know, but it wouldn't do to say. You make your own choice for this questionable distinction.

**Worst Section:** The editors say that first aid directions don't belong in an encyclopedia. I say they do. The ECT is going to be within easy reach of many engineers and chemists. If they ever want first aid they want it fast. It is not at all improbable that some day, somewhere, somebody will grab the nearest book that should have specific suggestions. It will be Vol. 6. And he will be wasting time. He will find no relief in reading lists of contents of two commercial first-aid kits. Or a page of bibliography, or a definition of first aid, or a suggestion that  
(Continued)

These thoughts—profound, shallow, amusing or otherwise—are from Vol. 6 of ECT and are quoted here . . .

### . . . Out of Context

#### Numbers to Forget

"The pH [of oysters] drops slowly during spoilage to values as low as 4.8." (p. 599)

"The fat of human hair contains 2% of behenic acid." (p. 257)

"Moisture and oil contents of fish flesh are inversely proportional. The sum is close to 80%." (p. 562)

#### Newspeak 1984

"Ginger provides strong stimulation of the warmth factor of mouthfeel." (p. 585)

#### Poverty

"Hatters of the mercury-carrot age had poor eyes, poor teeth, poor kidneys, poor hearts, indeed, poor everything." (p. 315)

#### Ammonium Nitrate

"Inorganic nitrates are noncombustible." (p. 534)

"Ammonium nitrate can be both a fire and explosion hazard." (p. 387)

"Molten ammonium nitrate is approximately as sensitive to impact as crystalline TNT at ordinary temperatures." (p. 21)

#### Now Hear This

"Fibers are of great practical importance." (p. 453)

"Available reports differ sharply and the subject seems to merit additional study." (p. 25)

#### Lo, the Poor Chemist

"Bordeaux mixture is a chemist's nightmare." (p. 985)

"The chemistry of the process is not fully understood." (p. 315)

#### That's Too Bad

"The higher branched-chain fatty acids are of little, if any, real industrial significance." (p. 262)

"Arachidic acid is found in tiger fat and is mainly of research interest." (p. 257)

#### Rest in Peace

"Thallium poisoning, while uncommon, is of great violence and increasing inci-

dence." (p. 851)

"Phenol, chloral hydrate or yellow phosphorus are occasionally used in both murder and suicide." (p. 852)

#### For Shame!

"This does not seem fair to U. S. fur cutters." (p. 315)

"Photography is a chemical process, but one largely absent from the chemist's repertory." (p. 848)

#### The Affluence of Incohol

"Ethanol is produced by many species of yeasts, bacteria and molds." (p. 357)

"Only the quantitative analysis for alcohol has any real toxicological significance." (p. 852)

#### For Cooks

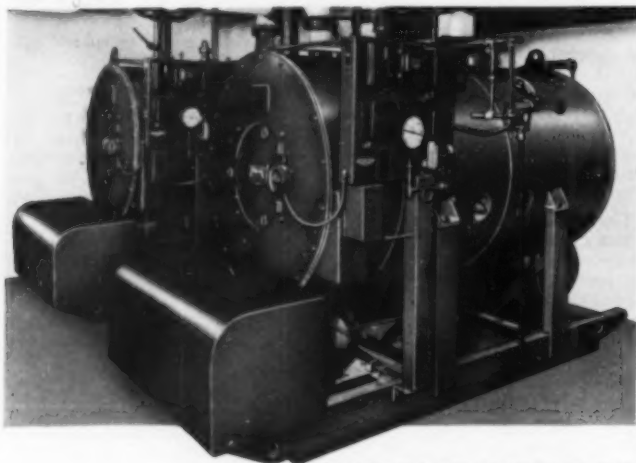
"Seasonings keep indefinitely on storage." (p. 585)

#### Bees & Flowers

"They reproduce by budding, which may occur at any region of the cell." (p. 357)

"The product of the first pressing is the so-called 'virgin' olive oil." (p. 159)

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*Industrial Division*

### BOOKSHELF, cont. . .

a chart be adapted to probable needs. What he wants is specific and immediate help. He won't get it.

**Best "Whodunit":** The nine pages of Forensic Chemistry is mighty interesting in its matter-of-fact gruesome. "The toxic agent is ordinarily contaminated by a complex mixture of tissue, body fluids, ingested food and other interfering materials from which the poison must usually be separated."

**Chemical Engineering:** "Flotation" by Spedden; "Fluid Mechanics" largely by Mott Souders, Jr.; "Extraction" by Lerman, Scheibel and Frey; and "Filtration" by Brownell are the unit operations appearing in Vol. 6. They are practical in their approach and coverage.

**Mathematics:** I got lost, and you may too, among the equations of "Film Theory." But the title (with "theory" in it) is ample warning.

**Commodities:** In addition to fluorine, Vol. 6 has four sections worth mentioning specifically: Folic Acid, Formaldehyde, Formic Acid, Furfural. Best and longest is on formaldehyde written by the well-known authority on the subject: J. F. Walker. They all stress chemical technology (naturally) and are not comparable to Chemical Engineering's commodity surveys or to Faith's "Industrial Chemicals."

**Other Sections:** When you get your Vol. 6 you will find some more meaty articles I haven't mentioned. Take a look at Fats, Fermentation, Fire Prevention, Foams, Fuels, Fungicides. They're all pretty good and worth perusing for general, if not specific, information. Some more worth reading but a little more marginal for us: Fish, Flame Throwers, Flavors and Spices, Food (Processing, Analysis, Preservation).

There. You should have a fair idea of what to expect in your sixth

### High Explosives Are Old Stuff

(Compiled from High Explosives; ECT, Vol. 6)

	Year Discovered
Mercury fulminate	1800
Lead azide	1850
Ammonium nitrate	1629
Tetranitromethane	1861
Ethylenedinitramine	1887
Nitroguanidine	1877
Glycol dinitrate	1876
Nitroglycerine	1847
Diglycerine tetranitrate	1861
PIETN	1891
Ammonol hexanitrate	1899
Nitrocellulose	1828
Nitrostarch	1833
Cyclonite	1899
Trinitrobenzene	1876
TNT	1863
Picric acid	1771
Ammonium picrate	1841
Tetryl	1877
Hexite	1874
Dynamite	1867

volume. Let's hope that we can have both guns and books. The ECT editors are already having trouble lining up authors for some of the sections you and I will see a couple of years from now. Authors are just as willing and there is no more secret-process trouble than usual. But defense comes first and they can't take the time for writing encyclopedic articles.

We may be half way to 12 ECT's but the editors are far ahead of us. Right now they are in Packages and in Petroleum.—LBP

#### RECENT BOOKS RECEIVED

Aminoplastics. By C. P. Vale. Interscience. \$2.75.

Basic Refractories. By J. H. Rait. Interscience. \$10.

Methods of Operations Research. By P. M. Morse & G. E. Kimball. Wiley. \$4.

Perfumery Synthetics and Isolates. By P. Z. Bedoukian. Van Nostrand. \$7.

The Polarographic Method of Analysis. By O. H. Muller. Chemical Education. \$3.50.

Principles of Phase Equilibria. By F. E. W. Wetmore & D. J. LeRoy. McGraw-Hill. \$3.50.

Report Preparation. By F. Kerekes & R. Winfrey. Iowa. \$6.90.

The Theory of Electrons. By L. Rosenfield. Interscience. \$2.25.

#### Research Directory

INDUSTRIAL RESEARCH LABORATORIES OF THE UNITED STATES, Ninth Edition. Compiled by Myron J. Rand. Published by National Research Council, Washington, D. C. 444 Pages. \$5.

Reviewed by Russell S. McBride

The growth of research as financed by industry has never been better demonstrated than in this new edition of National Research Council's valuable directory. It presents a descriptive list of 2,845 companies which operate such laboratories with an estimated expenditure by industry of nearly a billion dollars per year. Also included is a brief appendix listing the major research laboratories of the government and another appendix identifying the major "universities and colleges offering research service to industry."

The material for this directory was gathered during the first half of 1950 and it is comforting to know that "the book contains no unrevised information." Approximately a quarter of the industrial laboratories here reported were not in earlier editions.

More numbers in the alphabetic listing do not portray the whole story because there are in many cases grouped under single corporate titles as many as 10 to 30 laboratories. For

(Continued)

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Moreover, because Transite Industrial Vent Pipe is non-metallic and therefore

rustproof, it needs no painting or other protective treatment. Highly weather-resistant, it can be used for either indoor or outdoor service. A complete range of sizes up to 36" in diameter, with a full line of rustproof, corrosion-resistant Transite fittings, adapts it to practically any job requirement. It is light in weight and can be readily cut and drilled with ordinary tools.

For further information about Transite Industrial Vent Pipe, address Johns-Manville, Box 290, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario. Ask for Data Sheet Series DS-336.

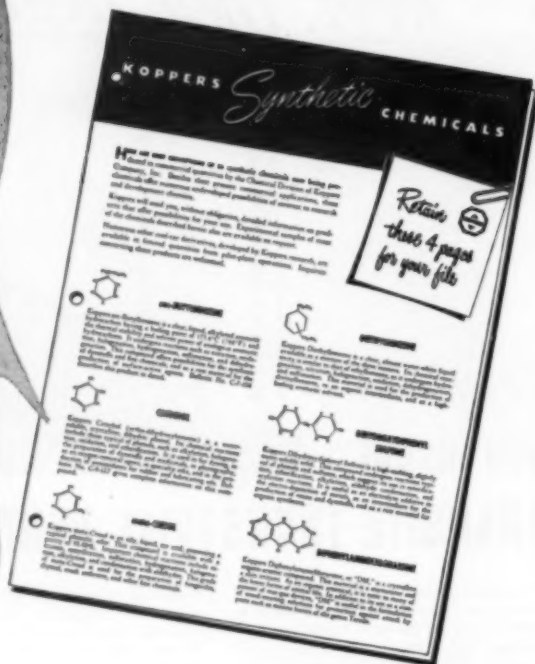
\*Transite is a Johns-Manville registered trade mark.

#### Typical industries in which Transite Industrial Vent Pipe is used:

Aircraft	Dairy	Gas	Paint	Shipbuilding
Automobile	Drug	Glass	Petroleum	Shoe
Baking	Electrical	Laboratory	Potash	Smelting
Bleaching	Explosives	Laundry	Pulp & Paper	Soap
Boiler Works	Farm Machinery	Leather	Quarrying	Soft Drink
Brewing	Food	Metals	Railroad	Sugar Refining
Canning	Foundry	Meat Packing	Rayon	Textile
Ceramic	Furnace	Metal	Refrigeration	Tool
Chemical	Furniture	Mining	Rubber	Water & Sewage

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## Here's information on KOPPERS Synthetic CHEMICALS



● Bulletin C-9-103, shown here, lists the properties, reactions and uses of 21 synthetic organic chemicals produced by Koppers Chemical Division. Most of these chemicals have established commercial applications; also, they are of interest to research and development chemists. This Bulletin describes the products shown on the right.

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Divinylbenzene  
Isopropyl Phenols  
beta-Methyl Umbelliferone  
Mono-tert-butyl-meta-cresol  
Nonyl Phenol  
Penacolite® Adhesives  
Phthalic Anhydride  
Propiophenone  
beta-Resorcylic Acid  
Resorcinol  
Sodium Cyanide Solution  
Sodium Sulfite  
Styrene Monomer  
Polystyrene

### BOOKSHELF, cont. . .

example, corporations like General Electric, Du Pont, Union Carbide, Westinghouse, and others have elaborate organizations with such a considerable number of separate laboratories, but their listing is so grouped that for each firm only a single number is assigned.

As in former editions there is given for each company the president, the executive officer in charge, and the names of two or three top immediate directors of the research staff. The scope of the subjects investigated is briefly summarized, but in sufficient detail to be very helpful for anyone unfamiliar with a single firm to get an understanding of the scope of its activities.

Excellent geographic indexing and a very satisfactory subject index facilitate identification of individual companies. But even so it is not easy to learn quickly the names of all organizations dealing with some of the more popular subjects like plastics, petroleum, electronics, and others. As many as 200 enterprises are frequently found in the index under these broad subjects.

The cordial cooperation of many research directors, for which the council expresses its appreciation, has made this the outstanding source of information as to the industrial scientific research of the United States.

### No Noddies

CHEMICAL ENGINEERING FOR PRODUCTION SUPERVISION. Second edition. By David E. Pierce. McGraw-Hill Book Co., New York. 209 pages. \$4.

Reviewed by E. K. Nicholson

In connection with the Defense Training program being sponsored by the U. S. Government prior to our entry into World War II, Dr. M. C. Molstad, University of Pennsylvania, approached David E. Pierce with the thought of preparing and giving a course in Chemical Engineering for non-technical personnel in production supervision.

In the absence of a suitable text, the course was based on original notes assembled by Mr. Pierce. The success of the course prompted publication of the first edition in 1942.

Defense is again an item of major importance. The new edition of this book should be of inestimable value in the up-grading of non-technical production personnel to fill the gaps caused by re-allocation of manpower and in obtaining the best possible results from chemical manufacturing



equipment that will be hard pressed.

The second edition closely follows the arrangement of the first edition. It is not cluttered with oodles of theory, but contains a number of numerical illustrations of the principles being discussed. There are also many practical problems, the solution of all being recommended by the author.

The material in the chapters on transformation of energy, heat transfer, evaporation, distillation, and flow of fluids has been clarified and amplified by the inclusion of developments and experience gained during the eight years since its original publication.

Outstanding additions, which materially increase the practical usefulness of the book, are a chapter on absorption; a nomograph for calculating the rate of flow of water through standard orifices, nozzles, and spray pipes; a nomograph for determining pipe sizes; and answers to a number of the problems.

While the book is intended primarily for the advancement of non-technical personnel in production supervision, it should also serve as an excellent refresher for technical personnel who have been in industry for a number of years and who are confronted with the necessity of preparing for examinations required in connection with their registration as professional engineers.

#### Fats and Oils

SOYBEANS AND SOYBEAN PRODUCTS. Vol. I. Edited by Klare S. Markley, Interscience Publishers, New York, 540 pages. \$11.

Production, properties, and processing of soybeans and soybean products are discussed in the first volume of a two-volume monograph. Twelve authorities have contributed chapters on those phases of the subject in which they have specialized. (Another group of 14 specialists will be found as authors of the chapters of Volume II. They will discuss solvent extraction processes and the utilization of soybean products).

This book, fourth in a series of monographs on the chemistry and technology of fats, oils, and related products, comprehensively describes the creation of new industries and the expansion of many long-established ones through the development of soybeans as a major agricultural crop in the United States. Although the editor apologizes for unevenness of emphasis by the different authors, some duplication of subject matter, and marked differences in style, he

(Continued)

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## Technical Topics

### RUST FORMATION ON 18-8 STAINLESS STEEL

NORMAN S. MOTT

Chief Chemist and Metallurgist

The popular conception that rust can never form on 18-8 stainless steel unless something is wrong with the chemical composition or the heat treatment, is a long way from the truth. Experience has shown that rust can occur on stainless alloys of controlled composition and heat treatment as the result of surface contamination. Among the many sources of contamination which may contribute to the formation of rust on the surface of stainless steels, the following are leading offenders:

1. An iron film left on the surface as the result of a machining or other manufacturing operation will tend to rust in the presence of moisture.
2. Microscopic scale particles left on the surface after pickling may become visible as "rust" under suitable conditions.
3. Pickling solution oozing from minute pores in the metal may stain the surface and oxidize to a brown rust color due to the iron which it contains.
4. The accumulation of the natural corrosion products of the alloy in corrosive service on a rough surface may cause a brown stain due to oxidation.

5. Discoloration may be caused by the accumulation of any extraneous processing material which is of such a nature as to cause a "rusty" appearance on a rough surface.

Articles that are to have a truly "stainless" appearance should have all scale completely removed by suitable cleaning methods, should be passivated after machining operations in warm dilute nitric acid, should be free from porosity, and should have a reasonably smooth surface.

A smooth or polished surface will always stay cleaner and brighter, and be more resistant under mildly corrosive conditions than a rough surface and this tendency increases with the degree of polish. Although it is true that stainless steel is at its best when highly polished, it should be remembered that under strongly corrosive conditions this polish is soon removed. For most applications, it is the inherent resistance of the alloy that counts and "rust" conditions such as those described are relatively harmless. They are the results of surface contamination and in no way reflect the composition of the alloy or the effectiveness of the heat treatment.

#### Available on Request

Detailed technical chart giving comparative designations, analyses, properties and applications of stainless, corrosion and heat resistant alloy castings.



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Write today for our descriptive folders on any of these products. Ample experimental samples of Zinc Hydro and Sodium Hydro are yours for the asking. Virginia Smelting Company, Box 21, West Norfolk, Virginia.

## BOOKSHELF, CONT.

appears to have brought it into a treatise of real reference value to any chemical engineer in the field of fats and oils.

Author and subject indexes for the two volumes of this monograph will be at the end of Volume II. Pagination of the two volumes is to be consecutive rather than duplicating. Liberal use of tabular and pictorial material is noted.—GWM

## Government Buying

**DIRECTORY OF U. S. GOVERNMENT CONTRACTS AND CONTRACTORS.** Published by U. S. Bid Information, 3603 R Street N. W., Washington 7, D. C. 75 Pages. \$7.50.

This private company has compiled a directory of the government contracting activity from the beginning of the Korean war to mid-November outlining the advertising for bids and the negotiated contract awards which individually amount to \$25,000 or more. It is an excellent means for identifying government procurement offices and becoming acquainted with the sort of contracts placed by each. Also clear from the compilation are the identities of all major contractors who are doing business with the government and who may be in a position to sub-contract a portion of their business to smaller interested firms. Also obvious is the usefulness for determining the scope of competitor activity and the price at which competitive business is being taken.—RSM

## Plant Pigments

**CAROTENOIDS.** By P. Karrer and E. Jucker, translated and revised by E. A. Braude. Elsevier Publishing Co., New York. 384 pages. \$8.50.

Reviewed by Edgar A. Steck

The chemical industries all have plant problems, and that the pure research chemists have "plant problems" is well-indicated in this volume. Research in certain pigments known as carotenoids has necessitated work with large amounts of raw materials for the isolation of adequate pure compounds for study. This is a monograph concerning the complex interrelationship and detailed characterization of a group of biologically significant compounds. It is rather indicative of the internationalism of science that it was written in German by two outstanding Swiss chemists, translated by a capable British investigator and then printed in The Netherlands. For any who desire a handbook on the

carotenoid pigments, the present volume will serve most admirably. Relatively little revision of the original (1948) edition appears to have been done, but the translator has accomplished his task with the skill of blending and savoring a tasty dish. It may be of interest to note that the handsomely-bound book is less expensive than the drab original (\$13.50).

#### Phenomenological

CHEMICAL THERMODYNAMICS.  
By Irving M. Klotz. Prentice-Hall, New York. 369 pages. \$6.

Reviewed by Kenneth A. Kobe

The year 1950 saw at least three new books on chemical thermodynamics published in this country. What distinguishes one from another? The viewpoint, the rigor with which the principles are applied, and the objective to be attained are the distinguishing characteristics. The author of this book has appended a subtitle, "Basic Theory and Methods," and stated that the book has been kept within limits that can be covered in a course of lectures for 12 to 15 weeks. This has meant the deletion of much material that would appear in a more extended text. The author has made an excellent selection of fundamental material and important applications.

In his treatment of theoretical principles the author has adopted the classical, or phenomenological, approach to thermodynamics and has excluded entirely the statistical viewpoint. This permits the "operational" approach to abstract concepts to be stressed.

The tenor of the book is set by the second chapter on mathematical apparatus which is one of the longer chapters in the book. Partial differentiation, exact and inexact differentials, homogeneous functions, graphical differentiation and integration and methods of fitting an algebraic equation to a set of data are discussed in such a way that a student with the ordinary background in calculus will understand the methods used extensively in thermodynamics. These methods are then used to develop rigorously the equations of thermodynamics.

The first half of the book is devoted to the first, second, and third laws of thermodynamics and shows their individual applications. The second half of the book is the application of these laws to systems of variable composition. To do this the concept of partial molal quantities is developed thoroughly and lucidly. The function chemical potential is mentioned

(Continued)



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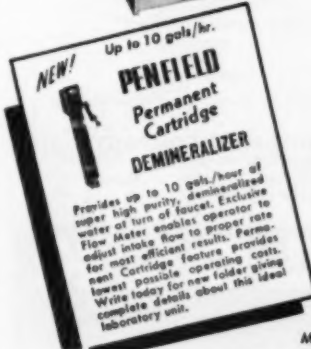
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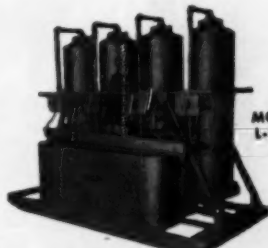


Produce solids-free water of exceptionally high purity... Penfield industrial de-ionizing units such as the 1000 gals./hour model illustrated at right, transform raw water into uniform quality water containing zero to two parts per million of ionizable salts and a pH of 6.5 to 7.5—under the proper conditions, even remove CO<sub>2</sub> and SiO<sub>2</sub>. Electric conductivity meters provide continuous indication of purity, warning when resins need simple regeneration.

MODEL  
U-60



MODEL  
L-1000



Self-contained units, requiring no heat or steam power for operation... Penfield Demineralizers are compact, completely assembled in stainless steel cabinets, "package" units—needing only connection to raw water source, drain and electrical outlets. Units such as the 60 gals./hour model illustrated at left, even may be used as "portable packages." In all cases, Penfield Demineralizers are ready for immediate operation upon arrival at site. No preliminary "boil-out," heat or steam power is ever required.

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## BOOKSHELF, cont. . .

though its significance is not shown beyond partial molal free energy. Fugacity of gases is developed clearly and then applied to ideal and real solutions. One short chapter is devoted to standard states and the function activity. The author does not go beyond solutions subject to atmospheric pressure, for the standard states of pure liquids and solids and solvent in a solution are defined in a standard state only as the pure substance at one atmosphere pressure. Only the final chapter is devoted to strong electrolytes, so they do not monopolize a large portion of the book as they do in many texts on chemical thermodynamics.

Some innovations in format are noteworthy. The table of contents is quite detailed and given in outline form with indicated subdivisions which are then indicated in the text itself. The illustrations are ample to show the applications of the methods involved.

The reviewer was impressed with this book as a relatively short one that treated rigorously the principles of thermodynamics and their applications, most of which are of importance to the chemical engineer. The "operational" approach and explanation of graphical methods gives the reader a firm hold on experiment and application. The book is recommended for serious study for itself and to supplement other texts lacking this fundamental approach.

## Recent Books & Pamphlets

**Chemical Statistics.** "Chemical Facts and Figures: Useful Information and Statistics Relating to the Chemical and Allied Products Industries." Production, sales, imports, exports, and prices of chemicals, chemical products, and chemical raw materials for the period 1946 through 1949. Part of a continuing record of chemical industry statistics; previous editions covered the periods 1929-1939 and 1940-1945. Financial records are included for 100 leading chemical process companies on an annual basis for the ten years 1939-49. Developments since the last edition have warranted data on 500 new chemicals, a new section on minerals, 419 pages. \$2. Third edition. *Manufacturing Chemists' Assn.*, 330 West 42nd St., New York 18, N. Y.

**Review and Forecast.** "This War and the Chemical Process Industries." The past year's trends and their probable meaning. Sections on: Mobilization; Law & Government; Plants & Processes (includes a 42-in. chart listing firms with projects underway—location, cost, products, job status); Supply & Demand; Labor; Profit & Loss; Prices. Reprinted from February 1951, *Chemical Engineering*, 32 pages. \$1. *Chemical Engineering*, Editorial Dept., 330 West 42nd St., New York 18, N. Y.

**Alkali.** "International Cartels in the Alkali Industry." Analyzes economic and business relations giving considerable information of technical interest. 30 cents. Federal Trade Commission Report, Superintendent of Documents, Washington 25, D. C.

**Stockpiling.** "Stockpile Report to the Congress." Describes the commodities considered for stockpiling and gives the

organization and purchasing policy of interest to firms wishing to sell to the government. Gratis. Munitions Board, Washington, D. C.

**Atomic Energy Commission.** "Ninth Semi-annual Report." Summarizes work of fiscal year 1950 and reviews present contracting policy of AEC. Gratis. Atomic Energy Commission, Washington, D. C.

**Fundamentals of Smoke Abatement.** Smoke control regulations, methods of measurement of smoke density and of prevention of smoke in industrial equipment. It is useful for the plant operator in his own establishment and to determine methods of prevention of smoke nuisance from the neighbors. By J. F. Barkley. Gratis. Information Circular 7588, Bureau of Mines, Pittsburgh 13, Pa.

**Lactic Acid.** "Properties and Reactions of Lactic Acid—A Review." By C. H. Fisher and E. M. Filachione. Gratis. AIC-279, Eastern Regional Research Laboratory, Philadelphia 18, Pa.

**Alcohol.** "Methods and Costs of Producing Alcohol from Grain by the Fungal Amyglase Process on a Commercial Scale." Gratis. Technical Bulletin 1624, U. S. Department of Agriculture, Washington, D. C.

**Solvent Extraction of Oilseed.** Preliminary operations, basic principles, batch and continuous methods (flow charts and photographs show German and American equipment), separation and purification of byproducts, economic aspects. Reprinted from January 1951, *Chemical Engineering*. By E. P. Coffield, Jr. 14 pages. 75 cents. *Chemical Engineering*, Editorial Dept., 330 West 42nd St., New York 18, N. Y.

**Acrylonitrile.** "The Chemistry of Acrylonitrile." Synthesis, physical properties, chemical reactions. Discusses its use in synthetic fibers, Buna-N synthetic rubber and plastics. Summarizes potential applications in adhesives, antioxidants, dyes, cable and wire insulation, graphic arts, insecticides, paper and solvents. Hard bound. 96 pages. Gratis. American Cyanamid Co., 50 Rockefeller Plaza, New York 20, N. Y.

**Gulf Coast.** "Texas Gulf Coast Chemical Empire." Progress report for 1950. New plants and expanded production facilities recorded cost over \$100 million. 14 pages. Gratis. South Texas National Bank of Houston, Industrial Dept., 213 Main St., Houston, Tex.

**Phosphorus.** "Phosphorus: Properties of the Element and Some of Its Compounds." Reviewed and classified: basic information of current or potential significance in production of fertilizers and munitions taken from the literature and from TVA's experimental investigations. By T. D. Farr. 84 pages. 30 cents. TVA Chemical Engineering Report No. 8, Superintendent of Documents, Washington 25, D. C.

**Metal Identification.** "Symposium on Rapid Methods for the Identification of Metals." Nine papers covering techniques of particular value when testing must be done in the field. 78 pages. \$1.75. STP No. 58, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

**Plant Location.** "Plant Location Directory of Basic Chemical Products." Listings for the entire U. S. on: anhydrous ammonia, caustic soda, chlorine, hydrochloric acid, industrial alcohol, nitric acid, salt and brine, soda ash, sulphur, sulphuric acid. 13 pages. \$1. Pub. No. 226, Tennessee State Planning Commission, Industrial Development Division, Nashville, Tenn.

**Analysis.** "The Analytical Balance: Its Care and Use." Deals with the problems of selecting, mounting, cleaning, adjusting, testing for performance characteristics, repairing. By W. M. MacNevin. 60 pages. \$1.50. Handbook Publishers, Inc., Sandusky, Ohio.

**Applied Chemistry.** "Reports on the Progress of Applied Chemistry, 1949." Articles by specialists in 30 segments of British chemical industry. Some fields covered: fuel; gas and destructive distillation; tar and tar products; acids, alkalis and salts; fats, fatty oils and detergents; rubber; antibiotics. Hard bound. 924 pages. Vol. XXXIV, Society of Chemical Industry, 58, Victoria St., London, S. W. 1, England.

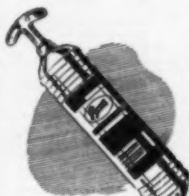
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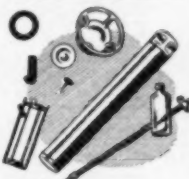
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## NEW TECHNICAL LITERATURE

Reader Service numbers. Circle them on the postcard inside the back cover to get free booklets.

SUBJECT	FEATURES	COMPANY
<b>Dry Mixing</b> 270A	Effective dry mixing of detergent compounds. A lead form which comes in two densities and a flake form. Recommends equipment and formulations to use with each. 4 pages.	Atlantic Refining Co.
<b>Oil Additives</b> 270B	Inhibitor and detergent-inhibitor types. Additive recommendations for the treatment of ten different base stocks for motor and diesel engine oils. 12 pages. Data sheet folder gives test results of various types and grades of oils.	Commerce Oil Corp.
<b>Aluminum</b>	Aluminum alloys and mill products. 117 tables cover physical, chemical and mechanical properties; standard tolerances; weights; standard sizes and production limits; fabricating data; relative corrosion resistance. 41 illustrations, mostly photographs, show operations in the production of aluminum. Wire bound. Requests for booklet must be made on company letterhead. 194 pages.	Reynolds Metals Co., 2500 South Third St Louisville, Ky.
<b>Instruments</b> 270C	Use of industrial and related instruments and apparatus in research and analytical studies. The company has given extensive mention to devices made by many organizations which are used in combination with its own instruments. Photographs show over-all systems for many research and analysis purposes; operation, design and performance of the equipment in the various systems are fully explained. 84 pages.	Minneapolis-Honeywell Regulator Co.
<b>Filter</b> 270D	Sand filter-clarifier; uses a spiral scraper that takes a cut off the sand bed when the filter rate decreases. Operating principles, typical performance data, capacities. Cut-away view; sketches showing general assembly and flow. 4 pages.	Hardinge Co.
<b>Mixers</b> 270E	Banbury mixers. Illustrates all sizes. Table of sizes and capacities cross-section and cutaway views showing details of construction, layout drawings showing various methods of installation in combination with other machines. 32 pages.	Farrel-Birmingham Co.
<b>Water Coils</b> 270F	Continuous tube water coils for heating and cooling. Illustrative problems show selection; numerous graphs and tables provide engineering data to guide choice. Includes a table of hyperbolic logarithms and a psychrometric chart. 22 pages.	Aerofin Corp.
<b>Pressure Vessels</b> 270G	Picture sequence aids description of fabrication of welded pressure vessels. Specifications and detailed engineering drawings of storage and truck tanks for liquid propane. 14 pages.	American Car and Foundry Co.
<b>Heavy-Media Separation</b> 270H	"Heavy-Media Separation Processes for Coal Preparation." Includes a standard flowsheet, one that shows the condition of the charge at various points with photographic inserts and one showing the twin cleaning circuit for full-size range treatment. Photographs and descriptions of seven heavy-media separation plants in operation. 36 pages.	American Cyanamid Co.
<b>Steam Generators</b> 270I	New line of packaged steam generators of water tube type. Produced in sizes from 75 to 800 boiler hp. For shipment in fully assembled condition. 8 pages.	Erie City Iron Works
<b>Mills</b> 270J	Two bulletins. The first covers swing-sledge mills and hinged-hammer pulverizers. Photographs show construction and parts. Specifications chart. 4 pages. Another covers ring roll mills. 4 pages.	Sturtevant Mill Co.
<b>Ball Joints</b> 270K	Photographs show 12 styles in which these flexible ball joints are made in sizes from 1/4 to 12 in. and in a variety of metals. Application photographs and sketches. Pressure rating charts. 16 pages.	Barco Mfg. Co.
<b>Stainless</b> 270L	Case histories on the use of stainless in the paper industry. Flow sheets; chart giving corrosion ratings. 12 pages.	Armco Steel Corp.
<b>Valves</b> 270M	For a line of bronze and iron body valves: photographs, dimensional diagrams, price, weight, size and dimensions. There are sections on accessories and essential engineering data. Fabricoid bound. 112 pages.	Stockham Valves and Fittings
<b>Plastics</b> 270N	"Evaluation of Stabilizers for Vinyl Stocks Containing Chlorowax 40." Reports on a laboratory study of two standard stabilizer formulations. Table covers chemical composition, approximate per-pound cost, physical form and specific gravity of 22 stabilizers. 10 pages. Another data folder details how this company's precipitated calcium carbonates meet the vinyl plastic compounder's requirements. 10 pages.	Diamond Alkali Co.
<b>Instruments</b> 270P	Electronically operated strip chart recorders. How direct deflection, Wheatstone Bridge circuit and pneumatic control types of operating systems apply to them. Accompanying price list. 4 pages.	Wheeler Instruments Co.
<b>Equipment</b> 270Q	Crushers, mills, dry batch mixers, batch blenders, air vibrators, cone vibrating screens. Photographs amplify construction and operation descriptions. 8 pages.	Sturtevant Mill Co.
<b>Turbines</b> 270R	General-purpose turbines for mechanical drive, this company's Type E, available in 16, 20, and 25 in. wheel sizes for application from 5 through 1500 hp. Covers construction and accessories available for adaptation to special requirements.	Westinghouse Electric Corp.



<b>Hydrogen Peroxide</b> 271A	Practical examples, various suggestions and a selection of literature references cover the depolymerization of starches, proteins and gums with hydrogen peroxide. 16 pages.	Buffalo Electro-Chemical Co.
<b>Impregnating Equipment</b> 271B	Systems for sealing, bonding or disinfecting with any acceptable material. Includes sizes and capacities chart for vacuum pumps and evacuating speed curves. 4 pages.	Lammert & Mann Co.
<b>Centrifuges</b> 271C	Operating principles and applications for two types of high speed horizontal centrifuges to continuously remove solids from slurries and suspensions. Cut-away machine drawings, specifications, installation shots, summary of applications. 8 pages.	Sharples Corp.
<b>Pumps</b> 271D	Construction, care and operation of positive displacement pumps, this company's Series GW and Series VW. Cut-away views, engineering drawings, specifications. 12 pages. Another bulletin covers a line of centrifugal pumps. 12 pages. Uses, power requirements and specifications for the models in this company's series 1200, 100 and 700. 4 pages.	Eastern Industries, Inc.
<b>Motors and Generators</b> 271E	Shows how this company's type SK dc. motors and generators use rolled steel frames, heavy steel brackets, steel shaft feet and prelubricated double-sealed ball bearings. Types, enclosures and mountings recommended for various applications. 10 pages.	Westinghouse Electric Corp.
<b>Dust Control</b> 271F	Sections on exhaust hoods and piping, seven types of dust collecting equipment, exhausters and drivers, maintenance of dust control systems. Photographs and line drawings show equipment and its operation. Written by W. D. Vedder. 36 pages.	Pangborn Corp.
<b>Plastic Pipe</b> 271G	Charts give chemical resistance and physical properties. Photographs show how it is handled. 4 pages.	Johnson Plastic Corp.
<b>Instruments</b> 271H	Flow rate testing for the aviation industry in particular. Engineering principles as well as detailed flow curves and charts. Describes newest calibration techniques; illustrates modern calibration panels. 20 pages.	Fischer & Porter Co.
<b>Lubricants</b> 271I	Line of specialized lubricants which are produced in various types. Recommends the proper lubricants for specific applications in chemical, food, pulp and paper, plastics, metal working and other industries. 54 pages.	Fiske Bros. Refining Co.
<b>Couplings</b> 271J	Series of photographs show how gear coupling is put together and points out purpose of each design feature. Phantom views show variety of types. 6 pages.	John Waldron Corp.
<b>Oils, Greases, Waxes</b> 271K	Products of low vapor pressure for high vacuum work. Properties, prices and specific applications are given for each member of the line. 4 pages.	James G. Biddle Co.
<b>Speed Drives</b> 271L	Basic operating principle, representative rating tables and dimension drawings of a line of variable speed drives. Also illustrates manual and automatic controls for use with them. 12 pages.	Reeves Pulley Co.
<b>Instruments</b> 271M	Proportioning, blending and process control equipment. Photographs of typical control panels and automatic valves, descriptions and specifications of precision units. Examples of complete systems that have been installed.	Richardson Scale Co.
<b>Gray Iron</b>	"Metallic and non-Metallic Coatings for Gray Iron." By C. O. Burgess. Methods of applying all known types of coatings. Includes 45 graphic illustrations of coated castings. 76 pages. \$1.75.	Gray Iron Foundry Society, 210 National City-East 6th Bldg., Cleveland 14, Ohio
<b>Chain Drives</b> 271N	How to install, maintain and operate roller chain; how to plan chain drive layouts. Lubrication and selection suggestions. Length conversion tables, horsepower rating charts, list prices, specifications.	Atlas Chain and Mfg. Co.
<b>Flooring</b> 271P	Open steel flooring and safety treads. Specifications, safe load tables, installation methods. 16 pages.	Dravo Corp.
<b>Combustion Controls</b> 271Q	Five case histories discuss the experiences of five companies with combustion control. Each includes a description of: boiler plant problem; specific conditions (load swings, steam demand, boiler rating) at the plant; how the control system operates with the related boiler plant equipment; results; a schematic drawing and photographs. Companies covered are: American Tobacco; Sherwin-Williams; Raybestos-Manhattan; Bemis Bros. Bag; Sunshine Biscuit. 8 pages each.	Hays Corp.
<b>Drier</b> 271R	To remove most of the oil, water and dirt from gas and air lines. Sketch shows operation. Chart gives capacities in cfm. of free air and some typical average cfm. requirements. 2 pages.	Logan Engineering Co.
<b>Screw Conveyors</b> 271S	Helicoid screw conveyors and accessories. All available types and assemblies are illustrated. Chart lists materials and specifications of proper conveyor to handle them. Illustrated suggestions on layout and design. 40 pages.	Fort Worth Steel & Machinery Co.
<b>Research</b> 271T	Report on the institute's activities during 1950. Descriptions of chemical engineering projects (the Carburo-lith process, uses for ethane and propane, explosibility limits of fogged insecticide, to name a few) cover 5 pages. Other fields represented are agricultural chemistry, mineral technology, engineering mechanics, physics. 45 pages.	Southwest Research Institute
<b>Aerosols</b> 271U	This company's facilities for formulation and testing of aerosol products. 4 pages.	Givaudan-Delawanna, Inc.
<b>Heat Exchangers</b> 271V	Facilities for designing and fabricating tailor-made exchangers for chemical processing, petroleum and pipelines. Sketches show telescopic, shell-and-tube, floating head exchangers and kettle type reboilers. 4 pages.	Western Supply Co.
<b>Ion Exchange</b> 271W	Describes equipment including softeners, hydrogen seolite, demineralizers, mixed-bed demineralizers. Specifications on package-type units. 8 pages.	Illinois Water Treatment Co.

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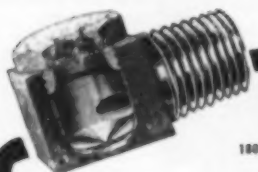
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<b>Instruments</b> 272B	Water level gauges: float, pressure bulb, pressure, capacitor, differential pressure, and air-bubbler types. Applications to chemical processing operations involving solutions, suspensions and organic liquids are described. Large number of photographs and drawings show typical installations. 24 pages. Another folder describes a t-le-meter for remote measurement and automatic control of variables over distances ranging from a few feet to many miles.	Bristol Co.
<b>Pumps</b> 272C	Screw and Rolex pumps, recent additions to this company's line of centrifugal and reciprocating pumps. Both are built in two standard types, gear-in-head and external gear and bearing and each can be furnished for either horizontal or vertical mounting. Two descriptive bulletins are available.	Warren Steam Pump Co.
<b>Research</b> 272D	Describes laboratory facilities and staff of newly formed firm specializing in research, consultation, analysis and testing, process development, economic and technical surveys. 4 pages.	Chemical Research Associates
<b>Ammeter</b> 272E	For ac and dc current-measuring. One-hand operation of the 25g lb. instrument and many examples of its use are pictured. 8 pages.	Columbia Electric Mfg. Co.
<b>Toxicant</b> 272F	Terpene chemical for use in space and residual sprays. Formulations and applications. 4 pages.	Hercules Powder Co.
<b>Linings</b> 272G	Corrosion proof sheet linings, solution or dispersion linings, brick sheathings and misc linings.	Athal Mineral Products Co.
<b>Fire Fighting</b> 272H	Lightweight, 1 qt., pressure type extinguisher; can be aimed like a gun. Pictures show operation and construction. 4 pages.	American-LaFrance-Foamite Corp.
<b>Microfilming</b> 272I	"Facts and Figures on Microfilming Engineering Drawings." Costs, equipment, film storage and processing. 12 pages.	Micro-Photo Service Bureau
<b>Fluorescent Bulb</b> 272J	A small, cool fluorescent bulb which can be screwed into any standard lamp socket. Life-sized illustration. 4 pages.	Stocker and Yale
<b>Lighting</b> 272K	Chart lists all RLM Standards Institute manufacturers and the RLM-certified lighting equipment made by each. 4 pages.	RLM Standards Institute.
<b>Safety</b> 272L	"Manual of Laboratory Safety." Well illustrated discussions of accident prevention, first aid, fire prevention, safety equipment. Recently revised. 40 pages.	Fiaber Scientific Co.
<b>Generators</b> 272M	Turbine-generators (500 kw. and above). Nearly 50 installations, both utility and industrial, are pictured and described. Detailed drawing shows typical turbine-condenser installation arrangement. Dimensions and weights of standard units are tabulated. 40 pages.	Elliott Co.
<b>Spray Nozzles</b> 272N	Recirculating spray nozzle systems for use in plants which operate condensers or use large quantities of water for cooling. Design, application, construction and operation. Diagrams show typical spray pond arrangements. Tables give size, dimensions, capacities and spray nozzle patterns. 8 pages.	Schutte and Koerting Co.
<b>Emulsifier</b> 272P	Automatic emulsifier for liquid resin size. Compact pre-assembled unit which is connected to tank and resin-size storage facilities. Engineering data, operation, flow diagrams.	American Cyanamid Co.
<b>Instruments</b> 272Q	Air-operated feed water control system. Three elements from which it is operated are steam flow from the boiler, feed water flow to the boiler and water level in the boiler drum. Diagrams, cutaway views, typical chart records, photographs of modern installations. 16 pages.	Bailey Meter Co.
<b>Safety</b> 272R	Series of photographs strikingly illustrate actual conditions that cause falls on the job. Designed to serve as a warning to workers. Pocket size. 16 pages.	National Safety Council
<b>Instruments</b> 272S	Speed measuring device requiring no contact with moving parts. It consists of a set of consecutively tuned steel reeds mounted in a case with a scale to indicate rpm, or vpm, of the reed or reeds as they begin to resonate. Pictures, applications and selection data for many ranges and types. 16 pages. Another bulletin covers ground testing instruments for measuring resistance of earth to ground connections and for measuring earth resistivity. 20 pages.	James G. Biddle Co.
<b>Magnetic Trap</b> 272T	Pressure-tight device for use in the food, chemical, ceramic and other industries to remove tramp iron from pipelines carrying liquids and semi-liquids. Drawings and specifications. 2 pages.	Eriss Mfg. Co.
<b>Laboratory Equipment</b> 272U	"Labitens," Vol. 1, No. 1, of a house organ to be published from time to time to report on progress in the laboratory apparatus field. This January 1951 issue includes an article on the use of the Cartesian manostat in the Brooklyn Battery Tunnel and a catalog supplement of newly listed laboratory equipment. 34 pages.	Emil Greiner Co.
<b>Corrosion Inhibitor</b> 272V	To control corrosion of steam and condensate lines by neutralization and by surface adsorption — a mixture of the most effective organic amines selected according to the volatility characteristics required by each steam-condensate system. Properties, applications. 2 pages.	Allis-Chalmers Mfg. Co.

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## **stops Beerstone before it starts**

Mild, non-toxic gluconic acid, used in dilute solutions after each run, effectively prevents the formation of beerstone by removing the freshly deposited material.

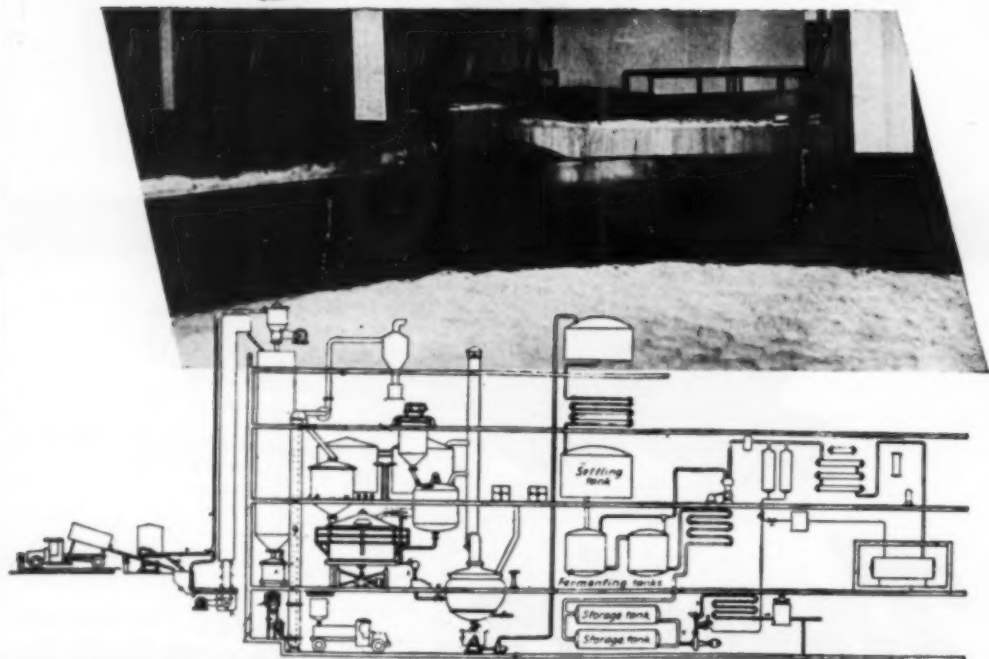
This method of preventing beerstone, rather than removing it after large deposits have formed, offers several important advantages:

1. *Non-corrosive.* No damage to the coating will result from application of this mild organic acid. Relining is unnecessary.
2. *Non-hazardous.* Gluconic acid solutions are non-hazardous to handle, eliminating difficulties which result when a strong acid is used.
3. *Non-toxic.* No undue precaution need be observed to remove the last traces of gluconic acid from the tanks.

In addition, because it is used in solution, gluconic acid is also convenient for cleaning lines, barrels and other brewery equipment. Write for complete information, samples and prices.



# PFIZER



# GLUCONIC ACID

CHAS. PFIZER & CO., INC., 630 Flushing Ave., Brooklyn 6, N. Y. • 425 North Michigan Ave., Chicago 11, Ill. • 605 Third St., San Francisco 7, Calif.

## First Quarter Output in CPI Points To New Records in 1951

Production in almost every section of the chemical process industries is pushing against capacities this quarter. In some places raw material problems continued to plague producers. To correct this problem the NPA plans to rejuvenate end-use allocations for some chemicals and minerals. High on the list of such materials will be sulphur and sulphuric. The order is being drafted along the lines of the general allocation order M-300 of World War II. This type of order will simplify industry's problems because it means that only one order will be needed to set up chemical controls. Lists of chemicals to which it applies can be changed as the supply situation in each individual case shifts. Producers and consumers will have only one basic order that they will have to keep up-to-date.

**Expanding Steel**—The current expansions in the iron and steel industry mean that output of coke-oven by-products will be bigger than ever in 1951-52. Use of chemicals by the industry will also hit a new high in 1951. Coke-oven capacities rose about 791,400 tons during 1950. The table below reflects the growing demand for chemicals to be used in the iron and steel industry.

Growing Capacity  
Thousand Tons

	Steel Furnaces	Blast Furnaces	Coke Ovens
1951	194,250	72,472	46,261
1950	95,392	71,497	45,469
1949	96,120	70,542	44,818
1948	94,233	67,439	42,507
1947	84,152	57,610	34,532

Last year's capital expansion was the highest on record, but \$1.2 billion will be spent in 1951 on expanding and modernizing steel capacities. This is 136 percent higher than the 1950 peak outlay and 307 percent above the amount spent in 1941. The money spent by the iron and steel industry to complete the current (1946-1952) expansion program will almost equal the total capital investment in the steel industry in 1946.

One reason is the drop in purchasing power of the dollar. From 1947-49 additions to capacities amounted to 8.2 million tons. Total expenditures were \$1.6 billion. From 1937-41 about 10 million tons were added to annual

### Supply & Demand

- For the first time in a year price rises in the chemical index failed to appear. As of March 1, the index was 118.98—same as of Feb. 1 index.

- Fats and oils failed to hold the line. They inched up another point during February. See next page.

- Synthetic rubber output climbed almost 50 percent in the first quarter of this year.

- Pulp and paper firms are placing a bigger load on chemical requirements. Reason: Bigger paper and board use.

capacities, but only \$1 billion was spent to supply the capital expansion. This increase in cost is reflected in the capital investment per employee. One of the steel firms is building an integrated steel plant to be finished in 1952. The new plant will cost \$400 million (\$91,000 per plant employee). This does not include the cost of land or cost of developing raw material sources.

**Bigger Paper Markets**—The tremendous demand for paper in recent months has focused attention on the comparative growth in each major consuming market of paper and paper board. These markets are (1) packaging, (2) graphic arts (3) construction and (4) sanitary uses.

In the past ten years use of paper and board in packaging has climbed about 40 percent. Use of these materials in the cultural and graphic arts has risen more than 50 percent. The construction industries' need for these products have shot up 120 percent above 1939 consuming rates. Sanitary uses for paper and board have more than doubled in the past decade. In the 1939-49 period consumption grew more than 109 percent.

While both packaging and the cultural & graphic arts outrank the construction industry, in terms of tons of paper and board used, the construction industry has become more and more dependent on paper and consequently on the chemical industries that supply

raw materials to pulp and paper mills. Large tonnages of asphalt have been pouring into board mills for use in insulating boards. About 25 percent of all insulating wallboard is being used as sheathing in new home construction.

The pulp and paper industry is currently consuming about 10 percent of our lime output, more than 90 percent of our salt cake production, about 7.5 percent of our sulphur production, more than 13 percent of our chlorine supplies, about 5 percent of our soda ash and more than 8 percent of our caustic soda output.

**Synthetic rubber**—Next month synthetic rubber output is scheduled to hit an annual rate of 900,000 long tons. This means that production of our synthetic rubber plants has almost tripled since the start of 1950. At the start of this year it was being made at the rate of 620,000 long tons per year. Actual output in 1950 was 476,000 long tons.

This rapid expansion in synthetic output makes the country much less dependent on imports of the natural rubber. This factor plus the limitations on civilian consumption of this product is making it possible to build up our strategic stockpile with a minimum of discomfort to essential civilian needs.

Last year world consumption of new rubbers was 2,240,000 long tons. This country consumed 1,246,000 long tons. Only 57 percent of our consumption was supplied by natural rubber. The rest came from synthetic units.

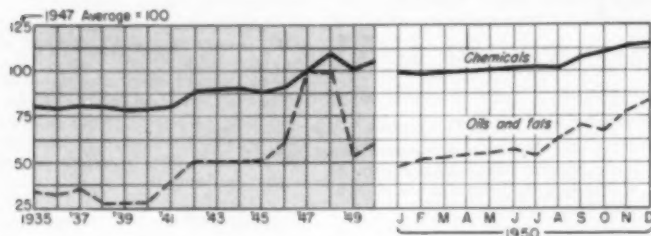
**Sulphur Demand**—Congressional investigation of the sulphur shortage has confirmed reports that we won't be able to meet all demands for sulphur in the coming year. The Abernathy Committee reported the following conclusions after hearing testimony from Texas Gulf Sulphur Co., Freeport Sulphur, and Duval Sulphur & Potash Co. (1) Demand (including export) will exceed supply by more than 500,000 long tons. (2) There is little immediate prospect of greatly increasing the supply of sulphur. (3) Problem in 1951 is to distribute the available supply where it will do the most good.

Texas Gulf Sulphur reports that they expect to have a Frasch process plant in commercial operation this year at Spindletop Dome, Tex. This plant has been under construction since October. They are currently exploring the likely spots in Mexico. However, no discovery has been made to date.



# Process Industry Trends

## PRICES

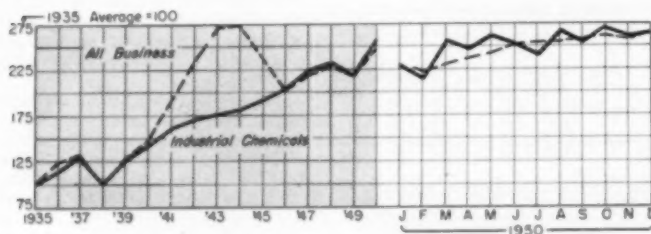


Chemical Engineering's Price Index

Chemicals—No change  
Oils & Fats Up—1.00

	Chemicals	Oils & Fats
As of March 1....	118.98	98.69
Last month .....	117.96	97.69
March 1950 .....	99.04	83.57
March 1949 .....	102.79	62.16

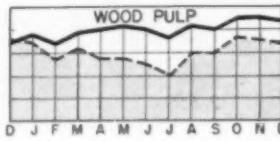
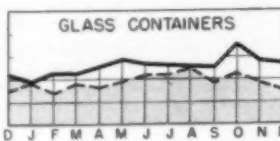
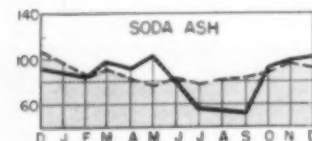
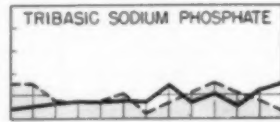
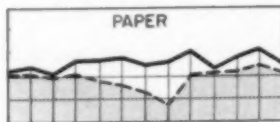
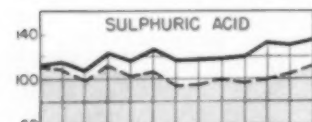
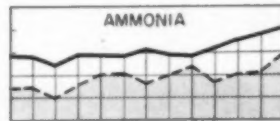
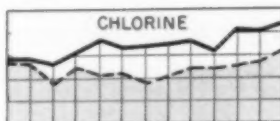
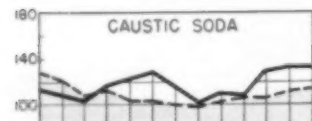
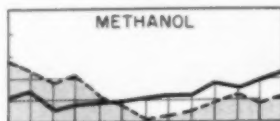
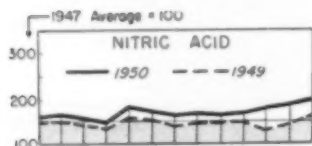
## CONSUMPTION



Industrial Chemicals Index

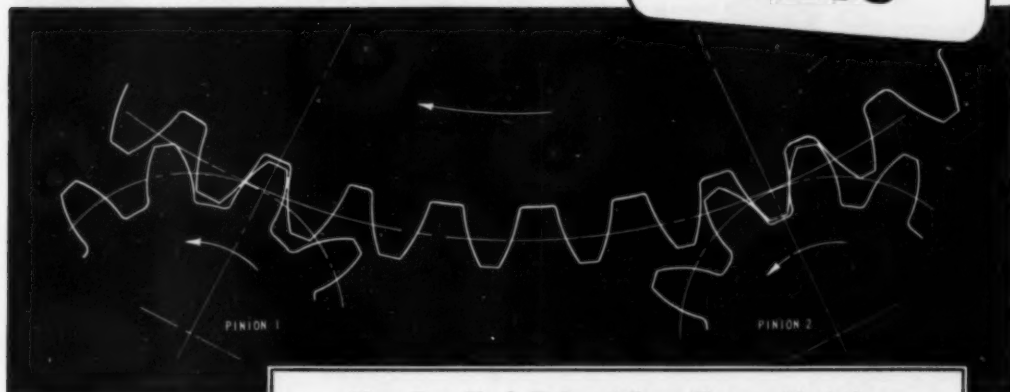
	November	December
Fertilizers .....	56.70	57.95
Pulp and paper .....	28.85	26.95
Petroleum refining ..	23.45	23.85
Glass .....	22.25	21.63
Paint and varnish ..	24.20	22.85
Iron and steel .....	14.70	15.38
Rayon .....	30.20	35.40
Textiles .....	12.58	11.96
Coal products .....	10.30	11.10
Leather .....	4.42	4.01
Explosives .....	8.73	8.26
Rubber .....	6.01	5.85
Plastics .....	17.41	18.40
INDEX .....	259.60	263.61

## PRODUCTION



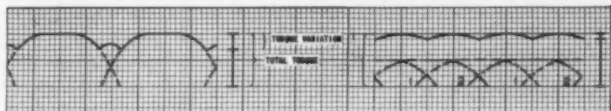
# Much Longer Life FOR ROTARY KILN DRIVES WITH...

**DUO-TORK**  
(STAGGERED PINION)  
**Drive**



*Duo-Tork drive eliminates "hard" gear tooth impulses. Pinion tooth in contact on pinion No. 1 is on centerline between gear tooth centers. Same tooth on pinion No. 2 is staggered — one-half tooth pitch past centerline.*

## How Duo-Tork Drive Affects Torque Variation



Single Drive with New A-C Gearing.

Duo-Tork Drive with New A-C Gearing.

**N**EW DUO-TORK drive is a staggered pinion dual drive for large rotary kilns developed by Allis-Chalmers to give you twice as many gear tooth contacts per kiln revolution as a single drive (see above). The result is a smooth drive that protects the kiln, bearings, gears, reducer, shafting, and motor from destructive vibration.

Pinions are staggered so that they are one-half tooth pitch out of step. Vibration caused by gear tooth contact is practically eliminated. Each tooth impulse has only half the force of a comparable single drive. And Duo-Tork drive assures continuous production because kiln can be operated at reduced

capacity using only half the drive.

Gear tooth shape has been improved, too. Duo-Tork drive utilizes the new 20° involute spur gear with long addendum pinion and short addendum gear tooth. The pinion tooth rolls evenly on gear tooth — smooth, even distribution of force from pinion to gear!

Other advantages of Duo-Tork drive:

► Eliminates need for large special reducers and flexible couplings.

► Lower tooth pressures mean better gear lubrication, with no scoring or "wiping" of gear teeth.

► Maximum economy. Duo-Tork drive is less costly than single drive of over 125 hp. And, because wear is reduced, gearing lasts longer.

For more facts, contact the A-C representative in your area or write Allis-Chalmers, Milwaukee 1, Wis. A-3280

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Duo-Tork and Terrapac are Allis-Chalmers trademarks.

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Kilns, Coolers, Dryers





## Counsel Offered ON METAL PROBLEMS

On January 1, 1951, National Production Authority Order M-14 respecting the consumption of primary nickel went into effect and subsequent amendments limit the applications for which nickel and its alloys may be used.

Within these limitations, we shall continue to issue information on new developments and user experience with nickel-containing materials, as we believe that dissemination of technical data and service experience can help to promote the intelligent utilization of critical materials, so essential in these times.

## "INCO" TECHNICAL SECTIONS

Consultation on technical problems relating to alloys containing nickel is invited. Consult the nearest Technical Field Section of INCO Development and Research Division listed below:

### CANADIAN SECTION

25 King Street, West,  
Toronto 1, Ont.  
Tel. Empire 4-1471

### CENTRAL ATLANTIC COAST SECTION

57 Wall Street,  
New York 5, N. Y.  
Tel. Whitehall 4-1000

### CHICAGO SECTION

212 N. Michigan Avenue,  
Chicago 1, Ill.  
Tel. Franklin 2-4030

### CINCINNATI SECTION

Carew Tower,  
Cincinnati 2, Ohio  
Tel. Parkway 1631

### DETROIT SECTION

General Motors Building,  
Detroit 2, Mich.  
Tel. Trinity 5-3435

### EMPIRE STATE SECTION

Genesee Valley Trust Bldg.,  
Rochester 14, N. Y.  
Tel. Locust 5854

### NEW ENGLAND SECTION

75 Pearl Street,  
Hartford 3, Conn.  
Tel. Hartford 4-5363

### PITTSBURGH SECTION

Grant Building,  
Pittsburgh 19, Pa.  
Tel. Atlantic 1-0546

### ST. LOUIS SECTION

Ambassador Bldg.,  
St. Louis 1, Mo.  
Tel. Gerfield 4197

### TEXAS SECTION

Commerce Bldg.,  
Houston 2, Texas  
Tel. Charter 4234

### TWIN CITIES SECTION

Northwestern Bank Bldg.,  
Minneapolis 2, Minn.  
Tel. Grace 0831

### WEST COAST SECTION

Petroleum Bldg.,  
Los Angeles 15, Calif.  
Tel. Prospect 2486

## STOCK AND SERVICE CENTERS FOR "INCO" PRODUCTS

The following are sources of supply for primary nickel for alloying purposes. Through casting specialists, they are prepared to offer technical service on the production of ferrous and non-ferrous castings containing nickel.

**ATLANTA 3**  
J. M. Tull Metal & Supply Co.  
285 Marietta Street  
Tel. Alpine 3871

**BALTIMORE 5**  
Whitehead Metal Products  
Company, Inc.  
4309 E. Monument St.  
Tel. Eastlawn 3288

**BUFFALO 2**  
Whitehead Metal Products  
Company, Inc.  
354 Court Street  
Tel. Cleveland 1475

**CAMBRIDGE 39, MASS.**  
Whitehead Metal Products  
Company, Inc.  
281 Albany Street  
Tel. Frobridge 4-6880

**CHICAGO 22**  
Steel Sales Corporation  
3348 South Pulaski Road  
Tel. Bishop 7-7108

**CINCINNATI 29**  
Williams and Company, Inc.  
3331 Fredonia Avenue  
Tel. Capital 3080

**CLEVELAND 14**  
Williams and Company, Inc.  
2789 Portina Avenue  
Tel. Utah 1-0880

**COLUMBUS 8, OHIO**  
Williams and Company, Inc.  
881 Williams Avenue  
Tel. Klondike 1623

**DALLAS 9**  
Metal Goods Corporation  
6311 Cedar Springs Road  
Tel. Elmhurst 2271

**DENVER 2**  
Metal Goods Corporation  
5428 Walnut St.  
Tel. Arcone 5881

**DETROIT 10**  
Steel Sales Corporation  
5181 Wesson Avenue  
Tel. Taylor 6-3880

**EDMONTON, ALBERTA**  
Wilkinson Company, Ltd.  
8411 163rd Street  
Tel. 35834

**HARRISON, N. J.**  
Whitehead Metal Products  
Company, Inc.  
1900 South 4th Street  
Tel. Ramrod 5-5008

**HOUSTON 3**  
Metal Goods Corporation  
111 Melby Street  
Tel. Crawford 3881

**INDIANAPOLIS 2**  
Steel Sales Corporation  
2000 North Illinois Street  
Tel. Yalbot 1198

**KANSAS CITY 8, MO.**  
Steel Sales Corporation  
2281 Grand Avenue  
Tel. Victor 7279

**LOS ANGELES 21**  
Pacific Metals Company, Ltd.  
1409 South Alameda Street  
Tel. Prospect 6171

**MILWAUKEE 9**  
Steel Sales Corporation  
2400 West Cornell Street  
Tel. Hilltop 2-2620

**MINNEAPOLIS 15**  
Steel Sales Corporation  
529 South 7th Street  
Tel. Nestor 6814

**MONTREAL 1**  
Robert W. Bartram, Limited  
486 Craig Street West  
Tel. University 2711

**NEW HAVEN 13**  
Whitehead Metal Products  
Company, Inc.  
585 Church Street  
Tel. New Haven 8-0575

**NEW ORLEANS 12**  
Metal Goods Corporation  
412 Julia Street  
Tel. Canal 7272

**NEW YORK 14**  
Whitehead Metal Products  
Company, Inc.  
303 West 10th Street  
Tel. Warkins 4-1569

**PHILADELPHIA 48**  
Whitehead Metal Products  
Company, Inc.  
1958 Hunting Park Avenue  
Tel. Baldwin 8-2323

**PITTSBURGH 33**  
Williams and Company, Inc.  
901 Pennsylvania Avenue  
Tel. Corcor 1-8008

**PORTLAND 12, ORE.**  
Eagle Metals Company  
2336 North Randolph Avenue  
Tel. Tazdo 5201

**ST. LOUIS 10**  
Steel Sales Corporation  
6363 Mulliken Avenue  
Tel. Grand 5354

**SALT LAKE CITY 4**  
Pacific Metals Company, Ltd.  
1188 South Main Street  
Tel. Salt Lake City 8-3421

**SAN DIEGO 1**  
Pacific Metals Company, Ltd.  
1812 India Street  
Tel. Franklin 9-5826

**SAN FRANCISCO 10**  
Pacific Metals Company, Ltd.  
3106 Nineteenth Street  
Tel. Mission 7-1104

**SEATTLE 4**  
Eagle Metals Company  
4755 First Avenue, S.  
Tel. Lander 9974

**SPOKANE 8**  
Eagle Metals Company  
East 228 Trent Avenue  
Tel. Madison 3419

**SYRACUSE 4**  
Whitehead Metal Products  
Company, Inc.  
207 W. Taylor Street  
Tel. Syracuse 3-0158

**TOLEDO 2**  
Williams and Company, Inc.  
650 East Woodruff Avenue  
Tel. Adams 6101

**TORONTO 5**  
Alloy Metal Sales Limited  
881 Bay Street  
Tel. Princess 2331

**TULSA 3**  
Metal Goods Corporation  
302 North Boston Street  
Tel. Tulsa 4-1175

**VANCOUVER, B. C.**  
Wilkinson Company, Ltd.  
186 West Second Avenue  
Tel. Fairmont 6101

# THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

## Ethyl Cellulose

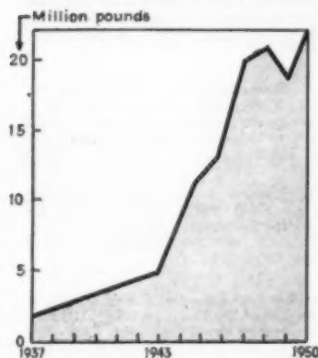
Supply is very tight as this plastic moves back into vital wartime uses. Two plants fill most orders.

Ethyl cellulose is back in tight supply. Both Dow and Hercules are pushing output at their producing units. Forty percent of both producer's manufacturing capacity has been earmarked for filling DO orders. Reason: It has many properties that make it extremely valuable in military equipment and in packaging. Uses include flexible lacquers, fast-drying varnishes, printing inks, adhesives, textile coatings, electrical insulation, w tougheners, transparent film, low-temperature heat insulators, molding powders, laminating binders and stripable film. The film can be applied by dipping, by brush or by spray.

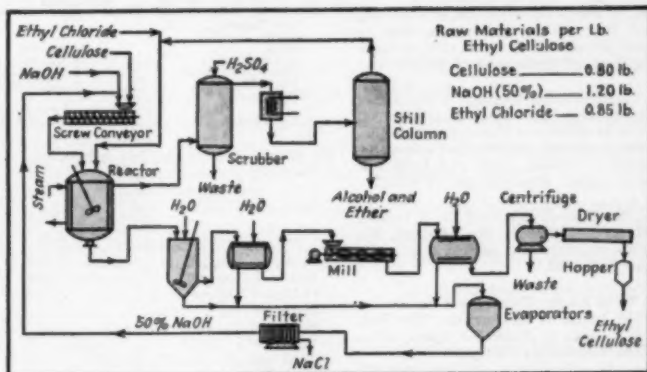
## MILITARY USE

Most renowned of all ethyl cellulose uses is the proximity fuse of World War II fame. In developing this fuse practically every known plastic was tested. Ethyl cellulose was chosen because of its toughness, close-tolerance molding and heat resistance. All this in spite of the fact that it is a thermoplastic material. Ethyl cellulose is the ethyl ether of cellulose. Other common cellulose derivatives (such as cellulose acetate and butyrate) are esters.

Both producers of ethyl cellulose originally had visions of greatness for this product. Its wide range of uses



**PRODUCTION** is growing.



**PROCESS** reactor is nickel-lined, steam-heated, autoclave tested for 700 psi.

seemed to mark it as one of the big tonnage resins back in 1937. However, its price tag keeps it out of many markets. It remains a special-use cellulosic.

All this may change in coming war years. Wider use for military purposes has already made an impact on supplies and soon new capacities may be arriving on the scene.

## HOW IT IS MADE

Ethyl cellulose is made by treating cotton linters or sulphite pulp with a solution of caustic soda to form alkali cellulose. The alkali cellulose is fed into a high-pressure steam-jacketed nickel-lined reactor. Ethyl chloride is also added. The exact amount depends on how much ethylation is desired. Normal commercial grades contain about 2.5 ethoxy groups per glucoside unit of the cellulose chain.

After the reactor is charged, the steam-heated jacket raises the temperature above 190°C. The alkali cellulose, excess caustic, and ethyl chloride react to form ethyl cellulose, ethyl ether, ethyl alcohol, and sodium chloride. After the reaction has been completed, the ethyl ether, alcohol and unreacted ethyl chloride are drawn off to a scrubber where these solvents are washed with a dilute sulphuric acid solution. Then the solvents are condensed and fractionated to recover the ether and alcohol for conversion to ethyl chloride and to permit recycling of the unreacted ethyl chloride.

Ethyl cellulose, salt and remaining caustic soda are dropped into a tank where the caustic soda-salt solution is drained off and fed to evaporators.

Precipitated ethyl cellulose in the tank is then washed with water and milled. The milled product is again washed and then centrifuged. From the centrifuge the product passes to a dryer. Dry ethyl cellulose then goes to loading hopper for packaging operations.

Salt-caustic solution and the wash water are pumped to double-effect evaporators where the salt is crystallized out of solution and the caustic is concentrated. The salt is filtered out and 50 percent caustic soda is recycled.

At the Hercules plant the concentrated mixture from the evaporator is cooled. Chilled caustic is pumped through Bird continuous centrifugals where salt is separated from the liquor. The sodium chloride crystals are carried to a continuous rotary filter. Here the occluded caustic is washed out and returned to the weak supply.

## OUTPUT

Production data on ethyl cellulose are not published regularly. However, the accompanying graph shows the growth of this chemical since commercial operation started in this country during 1935. In recent years non-coating uses have taken 8-10 million pounds per year. During the last war these uses were up to 11 million pounds annually.

Producing units are located at Dow's Midland, Mich., plant and at Hercules Powder's cellulose products division in Hopewell, Va. A number of firms market ethyl cellulose molding compounds under various trade names.

# New Construction

## Proposed Work

Calif., Ventura—Union Oil Co. of California, 617 West 7th St., Los Angeles, plant to construct an addition to its catalytic cracking plant. Estimated cost \$5,000,000

Ill., Chicago—Allied Chemical & Dye Corp., Barrett Div., 2800 South Sacramento St., plans to construct a plant for the manufacture of phthalic anhydride and increase facilities of refining plant and build new boiler house. Estimated cost \$4,500,000

Kan., Neodesha—Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill., plans to construct a refinery. Estimated cost \$2,500,000

La., Baton Rouge—United States Rubber Co., 1230 Avenue of the Americas, New York, N. Y., plans to double the capacity of its Buna-N synthetic rubber plant.

La., Baton Rouge—Solvay Process Div. of Allied Chemical & Dye Corp., Baton Rouge, plans to construct a soda ash chemical plant unit. Estimated cost \$2,750,000

La., Longville—Magnolia Petroleum Co., 335 North Front St., New Orleans, plans to construct a casinghead gasoline plant. Estimated cost \$2,000,000

N. M., Ennice—Skelly Oil Co., Ennice, plans to revise and expand its natural gas plant here. Estimated cost \$1,250,000

Okla., Okmulgee—Phillips Petroleum Co., Bartlesville, plans to enlarge its refinery for the manufacture of high octane gasoline. Estimated cost \$600,000

Okla., Velma—Skelly Oil Co., Velma, plans to enlarge its gas refining plant. Estimated cost \$2,000,000

S. C., Harleyville—Giant Portland Cement Co., Harleyville, plans to construct an addition to its plant. Estimated cost will exceed \$1,000,000

W. Va., Point Pleasant—Celanese Corp. of America, Point Pleasant Chamber of Commerce, plans to construct a plant. Estimated cost will exceed \$1,000,000

Tenn., Knoxville—Electro Manganese Co., Proctor St., Knoxville, plans to construct a chemical plant. Estimated cost \$1,000,000

## Contracts Awarded

Ala., Decatur—Chemstrand Corp., c/o Daniel Construction Co. of Alabama, Birmingham, contractor, will construct a manufacturing plant. Estimated cost \$20,000,000

Ark., Bauxite—Aluminum Ore Co., c/o Aluminum Co. of America, 2156 Gulf Bldg., Pittsburgh 19, Pa., will construct an alumina plant here. Work will be done with own forces. Estimated cost \$55,000,000

Ala., Fairfield—Harbison-Walker Refractories, Fairfield, has awarded the contract for a plant here to Rust Engineering Co., Exchange Bldg., Birmingham, and Pittsburgh, Pa. Estimated cost \$4,000,000

	Current Projects		Cumulative 1951	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....			\$412,000	
Middle Atlantic.....	\$900,000		5,482,000	
South.....	\$8,250,000	104,750,000	26,080,000	35,449,000
Middle West.....	4,500,000	28,500,000	22,000,000	16,966,000
West of Mississippi.....	6,350,000	95,915,000	53,850,000	101,782,000
Far West.....	5,000,000		7,250,000	4,995,000
Canada.....	7,750,000			27,750,000
Total.....	\$24,100,000	\$237,815,000	\$149,130,000	\$192,839,000

Ca., Brunswick—Brunswick Pulp & Paper Co., Brunswick, will construct an addition to its plant. Work will be done by owners. Estimated cost \$5,000,000

Ill., Madison—Dow Chemical Co., Midland, Mich., has awarded the contract for a continuous rolling mill for magnesium sheet to United Engineering & Foundry Co., 948 Duquesne Way, Pittsburgh; rehabilitating plant and installing equipment to Austin Co., 16113 Euclid Ave., Cleveland, O. Total estimated cost \$26,000,000

Mo., St. Louis—Lever Bros., 80 Varick St., New York, N. Y., has awarded the contract for the construction of a detergent plant, including a 6 story processing unit and 3 story packaging unit to Bechtel Corp., 220 Bush St., San Francisco. Estimated cost \$5,000,000

Mo., Ladue (St. Louis P. O.)—Grove Laboratories, Inc., 2630 Pine St., has awarded the contract for a plant for the manufacture of pharmaceutical products, toilet preparations, etc., to Frun-Colton Contracting Co., 1706 Olive St. Estimated cost \$1,000,000

Mo., North Kansas City—Pittsburgh Plate Glass Co., 5th and Wyandotte Sts., Kansas City, has awarded the contract for an addition to its plant here to J. E. Dunn Construction Co., 929 Holmes St., Kansas City. Estimated cost \$500,000

La., New Orleans—Kaiser Aluminum & Chemical Corp., Airline Hvy., Baton Rouge, will construct a 200,000,000 lb. per year capacity aluminum reduction plant and power facilities here. Work will be done by owners. Estimated cost \$75,000,000

N. J., South Plainfield—Ken-Tile, Inc., 58 Second Ave., Brooklyn, N. Y., has awarded the contract for a factory here to Fred J. Brotherton, 185 Atlantic Ave., Hackensack, N. J. Estimated cost \$900,000

O., Marion—B. F. Goodrich Co., 500 South Main St., Akron, has awarded the contract for a plant for the manufacture of rubber products to Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost \$2,500,000

S. C., Anderson—Owens-Corning Fiberglass Corp., Nicholas Bldg., Toledo, O., has awarded the contract for a plant 175,000 sq. ft. floor space, for the manufacture of fiberglass yarn to Daniel Construction Co., 429 North Main St., Greenville.

Tex., Freeport and Velasco—Dow Chemical Co., Freeport, has awarded the contract for additions to its chemical plant, including electric power and boiler facilities, to Stone

& Webster Corp., 805 N. Esperson Bldg., Houston. Estimated cost \$10,000,000

Tex., Houston—J. M. Huber Corp., Oil & Gas Bldg., has awarded the contract for doubling the capacity of carbon plant now under construction to Stearns-Roger Mfg. Co., City Natl. Bank Bldg., Houston. Estimated cost \$1,000,000

Tex., Lubbock—Western Cotton Oil Co., subsidiary of Anderson-Clayton & Co., Lubbock, has awarded the contract for the construction of a cotton oil mill to Brown & Root, Inc., Box 3, Houston. Estimated cost \$2,000,000

Tex., McAllen—Taylor Refining Co. and Mayfair Minerals, Inc., McAllen, has awarded the contract for enlarging its cycling plant to Gasoline Plant Construction Co., N. Esperson Bldg., Houston. Estimated cost \$2,575,000

Tex., Rosenberg—Western Insecticide Co., Rosenberg, will construct a factory here. Work will be done by owners. Estimated cost \$90,000

Tex., Texas City—Monsanto Chemical Co., Texas City, has awarded the contract for expanding its chemical plant here, including electric power and utilities, to United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa. Estimated cost \$4,750,000

Tex., Port Arthur—Gulf Oil Corp., Port Arthur, has awarded the contract for the construction of an ethylene plant unit to the Lummus Co., 385 Madison Ave., New York, N. Y. Estimated cost \$10,000,000

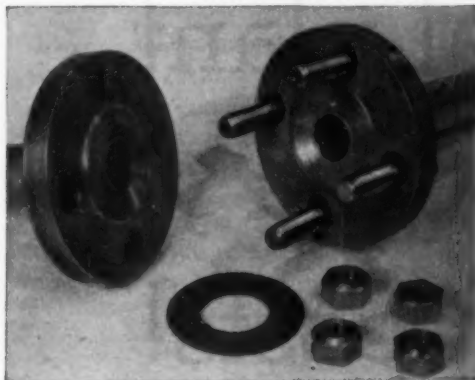
Okla., Pryor—National Gypsum Co., 111 West Washington St., Chicago, Ill., has awarded the contract for the construction of a plant here to Dittmars-Dickman Co., Manhattan Bldg., Muskogee, Okla. Estimated cost \$4,000,000

B. C., Bamberton—British Columbia Cement Co., Victoria, will construct a new kiln to increase the production of limestone. Work will be done by owners. Estimated cost \$2,000,000

Que., Montreal—North American Cyanamid, Ltd., Royal Bank Bldg., Toronto, has awarded the contract for a factory to J. L. E. Price Co., 680 Sherbrooke St. Estimated cost \$1,250,000

Que., Montreal East—Dominion Tar & Chemical Co., Ltd., Sun Life Bldg., Montreal, has awarded the contract for a glycol plant and facilities to E. B. Badger & Sons Co., 75 Pitts St., Boston, Mass. Estimated cost \$4,500,000



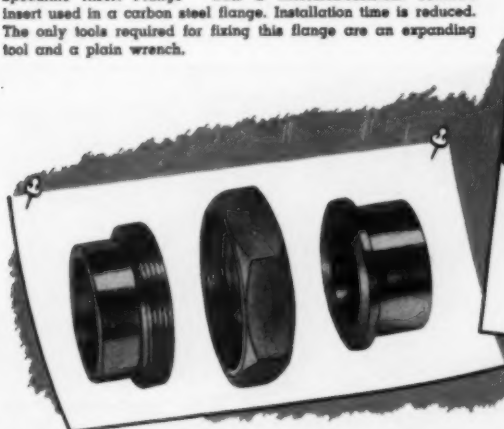
**NEW****Speedline fittings****OFFER SAVINGS on****CORROSION-RESISTANT PIPING JOBS**

*Speedline Insert Flange\** with a corrosion-resistant serrated insert used in a carbon steel flange. Installation time is reduced. The only tools required for fixing this flange are an expanding tool and a plain wrench.

The three main advantages you can get with the new *Speedline* fittings are:

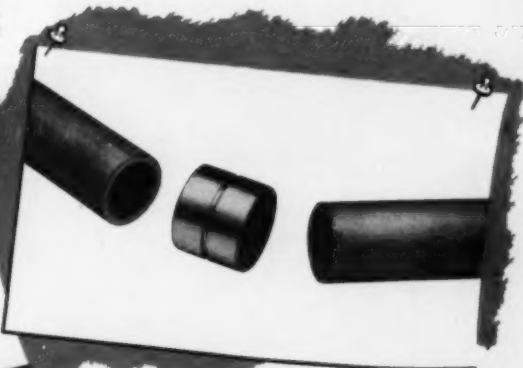
1. Improved piping layouts with greater flexibility and increased capacity through the use of light-weight Schedule 5 pipe.
2. Reduced installation costs because of simplified construction that frequently eliminates welding, vanstoning or threading of tubing or pipe.
3. Lower first cost when compared with similar fittings available today.

To discover how *Speedline* corrosion-resistant fittings can simplify installation and help you conserve critical materials, write for a copy of the *Speedline Fittings Book*.



*Speedline Tube Union\** combines the best features of screwed pipe unions and sanitary tube unions. It solves leakage problems frequently encountered with corrosion-resistant ground joints.

\*Patent applied for



*Speedline Aligning Connector\** can join Schedule 40 pipe (left) with light-wall Schedule 5 corrosion-resistant pipe. Or, used in complete installations of Schedule 5 pipe and lightweight O.D. tubing, it provides outstanding economy.

The *Speedline* Fittings described here as well as tees, elbows, etc. are made in A.I.S.I. grades of stainless and Carpenter Stainless No. 20. Other corrosion-resistant materials are used to meet specific conditions of service.



Sizes, Dimensions and Cost Comparison Data are in this 8-page *Speedline Fittings Book*. A table of pipe Schedules 5, 10, 40 and tubing cross-sectional areas gives useful information for planning piping layouts. Write for your copy today.

**HORACE T. POTTS CO.** Since 1815

Erie Avenue and D Street, Philadelphia 34, Pa. Baltimore Branch Warehouse 2835 Sisson St.  
GA 6-4600 HOPKINS 6800

**Speedline****Corrosion-Resistant FITTINGS**

—the newest thing in pipeline economy

# Chemical plant saves \$40,000 a year in power costs!

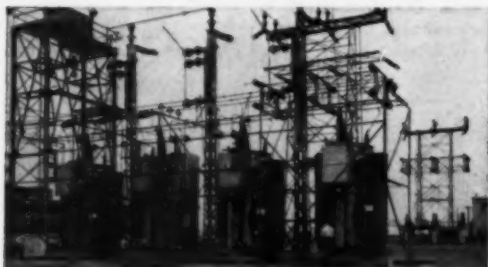


**1** Increased operating efficiency has been obtained by the installation of 3780 kva of 2400-volt G-E capacitors (two 1260-kva units shown) at this plant, which has a kva-demand clause in its power contract. In addition to correcting power factor, G-E capacitors can provide relief for overloaded circuits, or permit adding to fully loaded circuits.

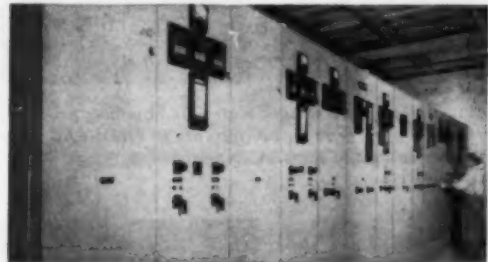
**GENERAL**  **ELECTRIC** 443-35

**G-E capacitors—recently installed in large West Coast chemical plant—yield an estimated 50% annual return, increase efficiency of plant's power distribution system!**

Savings realized by this company are just one example of the deep cuts that G-E capacitors can make in your chemical-plant power costs. Less dramatic, but vital to continuous production, is uninterrupted power supply. It's provided by reliable G-E power distribution equipment and co-ordinated to your individual needs by experienced G-E application engineers. For the whole story of the savings it makes possible, check your local G-E office—soon. *Apparatus Department, General Electric Company, Schenectady 5, New York.*



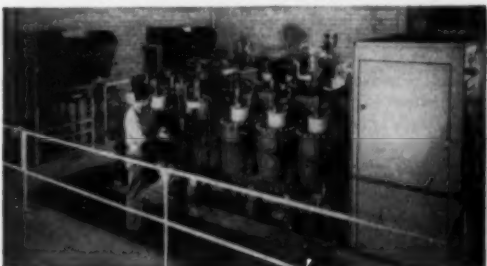
**2** Incoming utility power is stepped down at these 4 G-E 5000-kva transformers from 112 kv to 22 kv for primary distribution throughout the plant. G-E transformers are available in all kva ratings and voltages to meet a wide variety of chemical-plant needs.



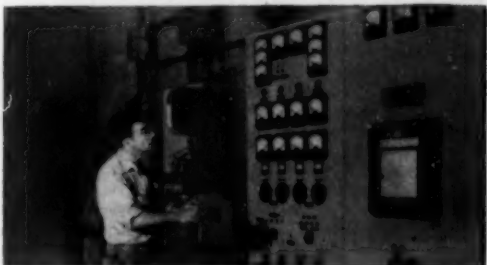
**3** For continuity of power to vital loads, the plant uses a secondary selective system utilizing a 7500-kva 22,000/2400-volt G-E double-ended unit substation. Indoor portion shown is G-E metal-clad switchgear, a compact, assembled unit that saves installation costs.



**4** Power losses are cut by G-E unit substations in load center systems. Shown here is the outdoor portion (two G-E 3750-kva transformers) of the plant's G-E unit substation that supplies power to miscellaneous compressor and motor loads located throughout the plant.



**5** Conversion from a-c to d-c for electrolytic processes is provided by these two G-E ignitron rectifiers, high in conversion efficiency, rated 3000 kw, 650 volts, 5000 amperes. Their control cubicles are shown in right foreground, and their anode circuit breakers in left background.



**6** Centralized control for the G-E ignitron rectifiers is obtained by means of this G-E switchgear and metering panel, where operator controls primary and rectifier breakers, and in addition obtains all necessary overcurrent relay, load current, and voltage indication.



**POWER  
DISTRIBUTION  
SYSTEMS**  
for Chemical Plants

**S  
W**



*pointers*

to

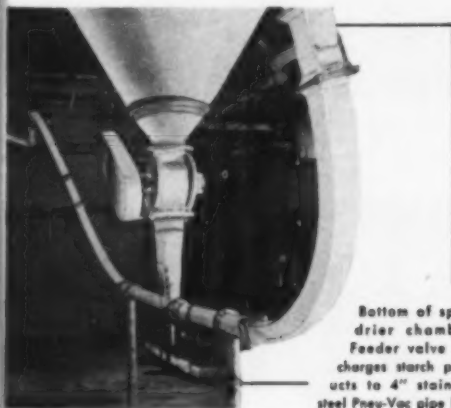
**BETTER  
PROCESSING**

## A. E. Staley Mfg. Co. Finds Answer to STARCH CONVEYING PROBLEM...

with

Sprout-Waldron **PNEU-VAC** System

**PROBLEM:** To convey starch products from spray chamber to packing area. Capacity required—2000 lbs./hr. Products are hygroscopic, tend to pack and lump when exposed to high humidity air. The conveying system is used for several different products; must be self-cleaning to avoid hold-up.



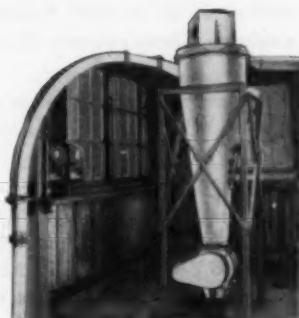
Bottom of spray drier chamber. Feeder valve discharges starch products to 4" stainless steel Pneu-Vac pipe line.

**OPERATION:** Dried products are discharged from drying chamber through rotary feeder valves to a 4" stainless steel Pneu-Vac pipe line. The Pneu-Vac elevates material to cyclone collector which feeds scalping screen at packing station.

Conveyor air is filtered, dehumidified by cooling, then reheated to obtain necessary low relative humidity. Operational control of the entire system is completely automatic.

Dust which escapes the cyclone collector returns to the primary drying chamber.

Pneu-Vac pipe line at left conveys product to collector where it discharges by gravity through feeder valve to screening and packing station below. Clean air is discharged through muffler at right.

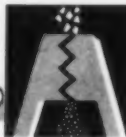


**RESULTS:** Continuous removal of product from drier chamber is accomplished without danger of foreign matter contamination, or mixing of various products. Stainless steel construction insures product cleanliness. Loss of hygroscopic materials due to packing or sticking to conveyor surfaces is eliminated.

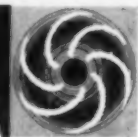


Product from collector drops to vibrating screen and then to packing bin, from which it is drawn off in drums and multi-wall bags. Pneu-Vac pipe line carrying product from drier to collector is shown in upper left.

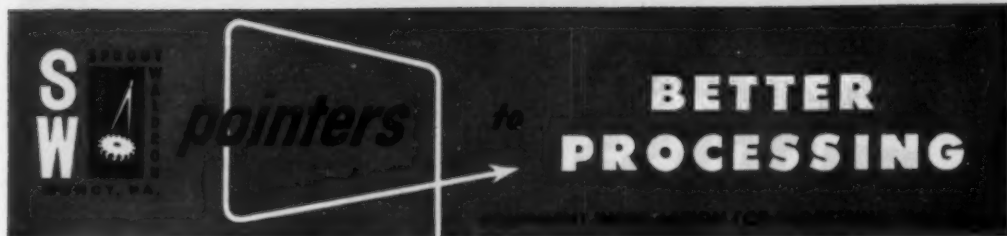
*If you have a bulk materials handling problem, talk it over with Sprout-Waldron. PNEU-VAC may prove to be the most efficient solution.*



DUST REDUCTION



MIXING & BLENDING



## Modern "Mix" Room at General Aniline Works, Rensselaer, N. Y.

—helps streamline the production of AZO DYES in country's oldest dye plant.

Sprout-Waldron Horizontal Batch Mixers receive the dye product after it comes from grinders. Here it is "standard-



ized" by addition of shading colors and reducing agents to match dye type. After mixing operation is completed, final product batch is sent to the weigher and prepared for shipment.

It's applications such as this that have established Sprout-Waldron as headquarters for mixing equipment. Consult with Sprout-Waldron on your requirements.

For further information about any of the equipment described, write to Sprout, Waldron & Co., Inc., 15 Waldron St., Muncy, Pa.

## Sprout-Waldron

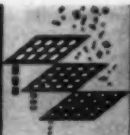
*Manufacturing Engineers*

SINCE 1884

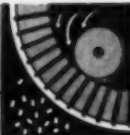
MUNCY - PENNSYLVANIA



BULK MATERIALS HANDLING



PRODUCT CLASSIFICATION

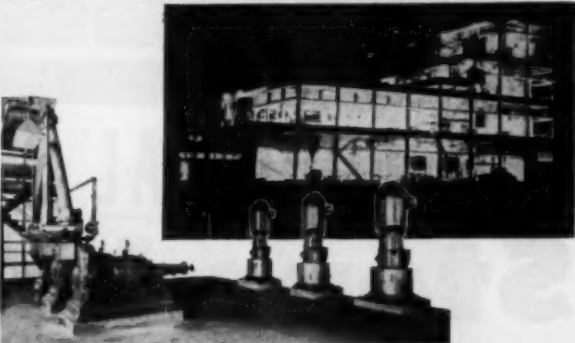


PELLETING & COOLING

## New Corn Products Plant Modernizes Starch and Sugar Production

The "Bluebonnet" plant at Corpus Christi, Tex., made headlines—not only because of its unique wall-less construction. Of even greater interest to the process industry are the much improved, continuous methods used to transform Milo Maize into starch and sugar. The engineers of Corn Products Refining Company broke with tradition—sought and found a better way to make starch!

Here, the old conventional stone-type buhr mill was replaced with modern-day degerminating mills, disintegrators, and repulpers . . . all specially equipped for starch processing.



At Corpus Christi, six Sprout-Waldron 36" single disc degerminating mills handle the full plant load of incoming grain, freeing the germ from the kernel without crushing it. After separation, three disintegrators and two S-W36" double disc repulpers take over and together do a job that formerly required six buhr mills, moisture expellers, and a three-stage coarse fiber washing station to get the same results.

Engineers of the "Bluebonnet" plant point out that the use of Sprout-Waldron repulpers, in combination with disintegrators, improves the recovery of starch, decreases maintenance costs, and requires considerably less floor space than previous methods.

Why not bring your size reduction problems to Sprout-Waldron? Our broad experience may be helpful to you, too!



# ALLIS-CHALMERS PROCESS PUMPS

THIS IS THE EQUISEAL STUFFING BOX with an auxiliary rotor that develops a low pressure area directly in front of the packing. On suction heads up to fifteen feet the pressure on the packing is zero.

## NEW EQUISEAL STUFFING BOX Stops Leakage

**I**F YOU MUST STOP PUMP LEAKAGE because of sanitation, corrosion or for any other reason, you can stop *all* leakage for suction heads up to fifteen feet by using the Allis-Chalmers Process Pump with the *Equiseal* stuffing box.

With this pump, maximum pressure on the packing is limited to suction conditions. When suction head is negative, leakage is no problem. When suction head is positive, however, packing pressure requires extra control to prevent leakage. This extra control is the *Equiseal* stuffing box with an auxiliary rotor that develops a low pressure area directly in front of the stuff-

ing box. Pressure on the packing is zero for suction heads up to fifteen feet.

The *Equiseal* stuffing box is so effective that the packing can be removed while the pump is operating on positive suction head and there will be no leakage even though there is a direct passage from pump suction to atmosphere. The *Equiseal* stuffing box can be added to your present Allis-Chalmers Process Pumps.

If you pump corrosives or abrasives, you should know about the *Equiseal* stuffing box. Ask your Allis-Chalmers Sales Office or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 08B6615. A-3247

*Equiseal*, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

# ALLIS-CHALMERS

Sold ...

Applied ...

Serviced ...

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



**MOTORS** — 1/2 to 25,000 hp and up. All types.

**CONTROL** — Manual, magnetic and combination starters; push button stations and components for complete control systems.



**TEXROPE** — Belts in all sizes and sections, standard and *Vari-Pitch* chevrons, speed changers.





Wyandotte Chemicals Corporation will be glad to send you, without charge, this extensive instruction chart on the handling of chlorine.

## How to handle chlorine

"Know-how" is essential to the safe and economical use of chlorine. If it's mishandled, it can be troublesome.

That's why Wyandotte's Technical Service is so valuable to our customers.

We will recommend handling equipment for unloading systems... instruct you in the use of the system. If you wish to vaporize the chlorine, we will design equipment which fits your requirements. We will recommend materials of construction... will submit a cost estimate in detail.

If you wish to improve your control, we will recommend suitable instrumentation. We will make periodic inspections of your equipment. We will instruct your personnel. These services are available to every Wyandotte customer... large or small. They can be available to you.

For details, write us at the address below.

**WYANDOTTE CHEMICALS CORPORATION**  
 WYANDOTTE, MICHIGAN • OFFICES IN PRINCIPAL CITIES

CHEMICAL ENGINEERING—March 1951

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA  
 CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE  
 HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS  
 CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE  
 DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES  
 OTHER ORGANIC AND INORGANIC CHEMICALS

 **Wyandotte**  
 REG. U. S. PAT. OFF.

## American Blower . . . a time-honored name in air handling



In Seattle, a leading university, as well as commerce, industry and public utilities, have made use of American Blower's Branch Office by calling Seneca 3860. To contact the American Blower Branch Office in your city, consult your phone book.



### PLEASANT IDEA . . .

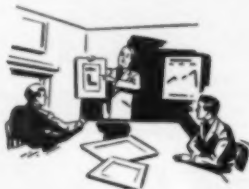
In Seattle, as in your home town, apartment house owners realize that invigorating, fresh air indoors can do much to attract desirable tenants. American Blower Utility Sets do just this. The Utility Set is ideal for general ventilation where duct systems are required. It can be used as a supply or exhaust fan and is equipped with Aileron Control for regulation of air flow. They're available as standard packaged units ready for immediate installation. Is there an idea here for you?



### PROFITABLE IDEA . . .

Fuel savings alone often will pay for a new heating system when you replace obsolete equipment with American Blower Unit Heaters. For example, a manufacturer of specialty equipment

investigated and found he could convert his whole plant to unit heaters and pay for the system in 3 years with the fuel savings alone. American Blower carries a complete line of Unit Heaters, including gas-fired models and models for steam or hot water heating systems, wall- or ceiling-mounted.



### FRESH IDEA . . .

We know an advertising agency in one of our larger cities that recently moved their offices into one of those beautiful old homes along the river. The ventilating system was adequate for a family, but converting it for commercial use posed some problems. But American Blower equipment solved them nicely. For example, smartly-styled Aeropel Fans now keep the conference rooms pleasantly fresh, Utility Blowers ventilate rest rooms, and Ventura Fans handle the large work areas. End result, they say—fresh air fosters fresh ideas.

### MAY WE SERVE YOU?

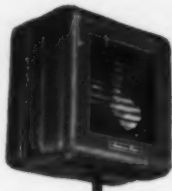
American Blower heating, cooling, drying, air conditioning and air handling equipment can do much toward improving comfort and efficiency in your business. For data, phone or write our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN  
WEST COAST PLANT: SAN LEANDRO, CALIFORNIA

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

## YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

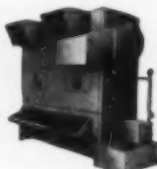
Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEAF • DETROIT LUBRICATOR • KEMMER DRILLERS • ROSS HEATER • TORAHANDA IRON



Unit Heaters



Ventura Fans



Air Conditioning Equipment

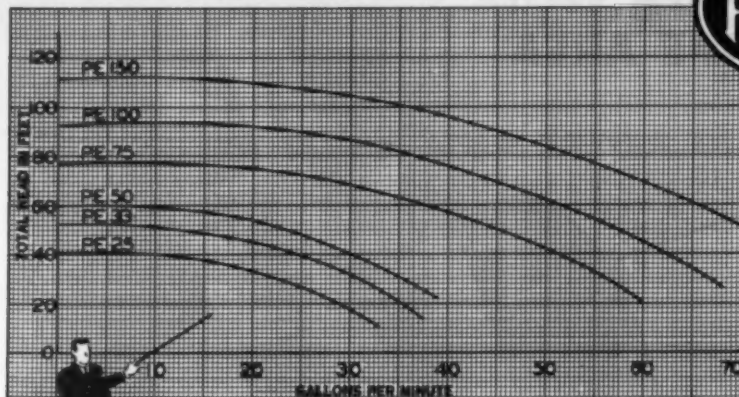


Industrial Fans



Utility Sets

# GRAPHICALLY ILLUSTRATING PEAK PERFORMANCE YOU GET WITH FRACTIONAL H.P. GENERAL PURPOSE PEERLESS FLUIDYNE END SUCTION PUMPS



## KEY TO CHART

Performance chart showing head-capacity characteristics of Peerless Type PE Fractional H. P. General Purpose Pumps at 3430 rpm.

## KEY TO PUMP H. P. IN CHART AT LEFT

PE 25—1/4 hp  
PE 33—1/2 hp  
PE 50—3/4 hp  
PE 75—1 hp  
PE 100—1 1/2 hp  
PE 150—2 1/2 hp

*Part of a complete line of Electric or Belt Driven or Flexible Coupled Pumps for circulating and booster service in all industrial plants*

SAME HIGH PERFORMANCE RATINGS CHARACTERIZE THE COMPLETE PEERLESS LINE IN ALL SIZES FROM 1/4 H.P. TO 150 H.P. ALL TYPES OF DRIVE AVAILABLE

In addition to its peak performance ratings, Peerless offers:

1. Four different types of drive—close coupled electric, V and flat belt pulley and flexible coupled with pump and motor on common base. You select the pump best suited to your needs from a

head range up to 110 feet, from a capacity range up to 65 gpm and motor sizes up to 1 1/2 hp.

2. Simplicity in design, reflected in easy installation, long efficient life, ease of maintenance and replacement of parts.

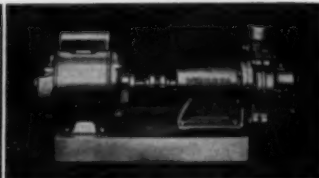
3. Available from stock in most types and sizes, in standard construction; factories at Los Angeles and Indianapolis.

4. Hydraulic characteristics superior to conventional pumps. Performance chart above illustrates the excellent efficiencies over the entire operating range of the fractional hp line.

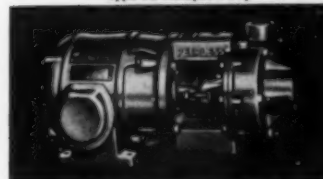
5. Non-overloading impeller design helping to prevent motor burn-out due to fluctuations under operating conditions.



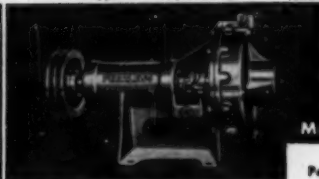
Fractional HP Close Coupled Electric Type PE Fluidyne Pump



Fractional HP Flexible Coupled Type PB Fluidyne Pump



Integral HP Close Coupled Electric Type PE Fluidyne Pump



Integral HP V-Belt drive Type PB Fluidyne Pump

## NEW BULLETIN

describes additional features of both fractional and integral hp pumps in the Peerless Fluidyne Line. Write for your copy of this 24-page fully illustrated and descriptive bulletin by mailing coupon today.



## MAIL COUPON TODAY

Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif.

Please send without obligation new Bulletin B-3500 describing Fluidyne line of fractional and integral hp pumps.

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

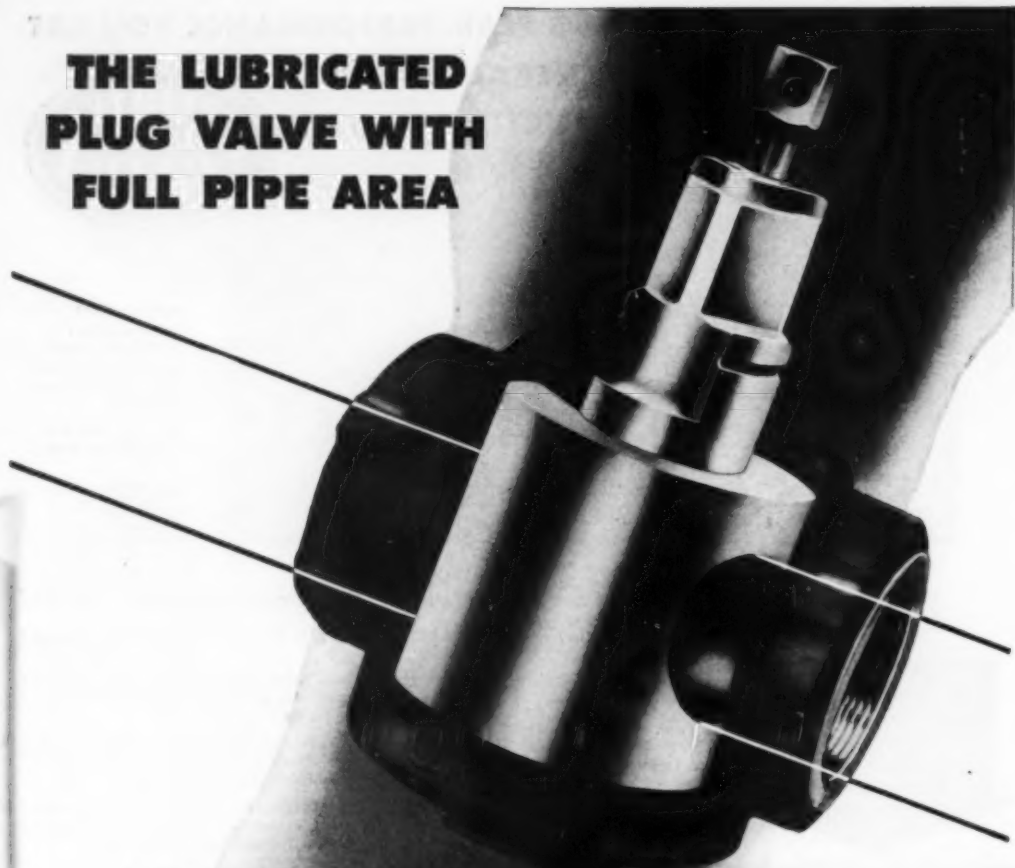
C. E.

## PEERLESS PUMP DIVISION FOOD MACHINERY AND CHEMICAL CORPORATION

Address inquiries to Factories at:  
Los Angeles 31, California or Indianapolis 8, Indiana.  
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix,  
Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.



# THE LUBRICATED PLUG VALVE WITH FULL PIPE AREA



## A.C.F. CYLINDRICAL PLUG DESIGN



makes it possible. Straight-through openings result in smooth, non-turbulent flow, lowest head loss, reduced valve abrasion. Yet compact valve construction is retained in both rectangular and round-port types. Reason enough for A.C.F. Lubricated Plug Valve preference.

**A.C.F.**  **PLUG VALVES**

Representatives in more than 50 principal cities

Write for Catalog 4-CM, describing types and sizes, to: American Car and Foundry Company, Valve Division, 1501 East Ferry Avenue, Detroit 11, Mich.



# POINTS TO CHECK ✓

## IN YOUR COOLING TOWER INVESTMENT

Here's what you get with a *C.H. Wheeler* Cooling Tower

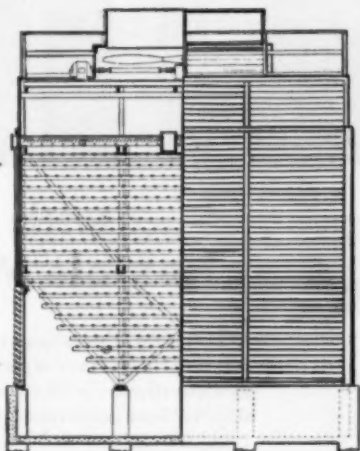
✓ **GUARANTEED COOLING RESULTS**—Names of installations near you sent on request. Repeat orders prove customer satisfaction.

✓ **GUARANTEED WIND-SAFE**—Standard construction for 100 miles per hour— (75 mph is hurricane velocity).

✓ **TWO TENTHS OF 1% DRIFT LOSS**—  
—Accurately placed Herringbone Drift Minimizers save on make-up water.

✓ **MOST EFFICIENT WATER BREAK-UP**—  
—Wood fill arranged for best combination of wetted surface and water drop surface to speed cooling.

✓ **NON-COLLAPSING FILL**—Rugged 2" x 2" redwood members sawed diagonally—last the life of tower.



✓ **ADVANCED DESIGN PLASTIC FANS**—  
—on large towers pioneered by C. H. Wheeler—adjustable pitch blades—20-1 safety factor.

✓ **CASINGS CONFORM**—to architecture—to fire codes—may be many materials, including redwood, asbestos cement board, masonry, brick, properly painted steel, etc.

✓ **NON-CORROSIVE ELEMENTS**—Fill is slot-fitted; no nails. Nuts, bolts, etc., furnished in non-corrosive metals. Plastic fan blades.

✓ **EASE OF ACCESS**—into all parts of tower, including the cooling space, for regularity of maintenance.

✓ **ENGINEERED FOR THE CLIMATE**—50 years of successful experience in building for arid, tropical and cold areas, including severe icing conditions.

✓ **CUSTOM BUILT**—Sure to satisfy your specific requirements.

✓ **INDUCED, FORCED, OR NATURAL DRAFT**

LITERATURE MAILED ON REQUEST ✓



VACUUM REFRIGERATION—COOLING TOWERS—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

CHEMICAL ENGINEERING—March 1951

Keep these *Dangerous* stresses

*out of piping  
and equipment*

- ✓ VIBRATION
- ✓ MISALIGNMENT
- ✓ FLEXATION
- ✓ EXPANSION and CONTRACTION



CMH Corrugated Flexible Metal Hose can be furnished in steel, bronze, stainless steel and other alloys. Depending on size, type and material, pressures up to 12,000 psi (burst) and temperatures up to 1600° F. can be handled.



CMH Convuluted Metal Hose is made in a variety of types and in steel, bronze and alloys. Depending on size, type and material, pressures up to 500 psi and temperatures up to 600° F. can be handled.

Flexon identifies CMH products that have served industry for over 49 years.



## CHICAGO METAL HOSE Corporation

1317 S. Third Ave. • Maywood, Ill. • Plants at Maywood, Elgin, Rock Falls, and Savanna, Ill.  
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

# CMH

**ONE DEPENDABLE SOURCE**  
for every flexible metal hose requirement

Corrugated and Convuluted Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems  
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

# HAMILTON WATCH COMPANY

## LABORATORY CHECKS ON MOISTURE IN COMPRESSED AIR

Date	Dep't	Dew Point	Grains/ cu. ft.	Remarks
4/20	Bal. & Flat S.	-50.0°C	.0124	Good
4/20	Works Lab	-50.0°C	.0124	Good
4/23	Bal. & Flat S.	-50.0°C	.0124	Good
4/23	Works	-50.0°C	.0124	Good
4/27	Works Lab	+4.0°C	2.800	Poor NOTE: This situation produced when the new compressor was thrown into use without passing the air through the Lectrodryer.
4/29	Bal. & Flat S.	-54.0°C	.0082	Good
4/29	Works Lab	-54.0°C	.0082	Good
5/3	Oil capsule changed			

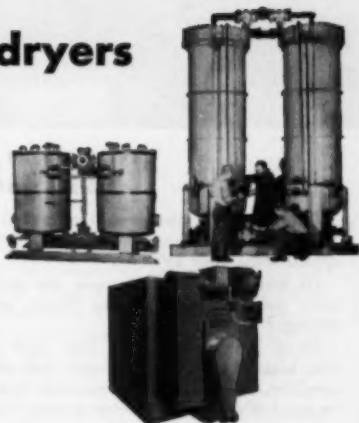
## A lab man's notebook tells why you need Lectrodryers

Page after page, the report on moisture conditions was "Good". Then *wham!* It jumped from a hundredth grain per foot of air to 2.8 grains. Howls of protest were heard all through this plant where precision products are made. "What's happened to our air?"

A new compressor had been placed in service, by-passing the old Lectrodryer. A quick switch was made and again the report became "Good".

Lab men's notebooks all over the world are telling this same story: Air, gases and organic liquids are being kept free of unwanted moisture by Lectrodryers. Processes are kept on the beam. Quality of products is maintained on production and in storage.

Find out what moisture is doing to your processes and products. Then let our engineers help correct those conditions. Write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Penna.



**LECTRODRYERS DRY  
WITH ACTIVATED ALUMINAS**

# LECTRODRYER

REGISTERED TRADEMARK U. S. PAT. OFF.



## "In Case of FIRE..."

In case of fire, what would your plant's chances be? Would a blaze go unnoticed and unchecked... free to spread from floor to floor?

Or would modern automatic fire protection equipment quickly extinguish the flames, minimizing any damage?

These are the questions that your insurance man asks himself... and the ones you should seriously consider *today!* For, with material shortages, fire can be more disastrous than ever before.

Increasing numbers of plants, warehouses, and institutions throughout the country have assured themselves of positive fire protection by installing an automatic sprinkler system and a Horton elevated water tank. This combination provides instant 'round-the-

clock service... seven days a week... year after year.

Most essential to this immediate action is the Horton elevated tank, for it supplies an independent water supply backed by dependable gravity pressure. Water flows the instant it's needed.

Most modern of the Horton tank designs is the Watersphere, shown above. Many plants find it ideal because it is both functionally efficient and attractive in appearance.

Waterspheres are built in standard capacities from 25,000 to 250,000 gallons, in any height to bottom required. Our nearest office will be glad to furnish estimating data. When requesting quotations, state capacity, height to the low water line, location and type of insurance carried.

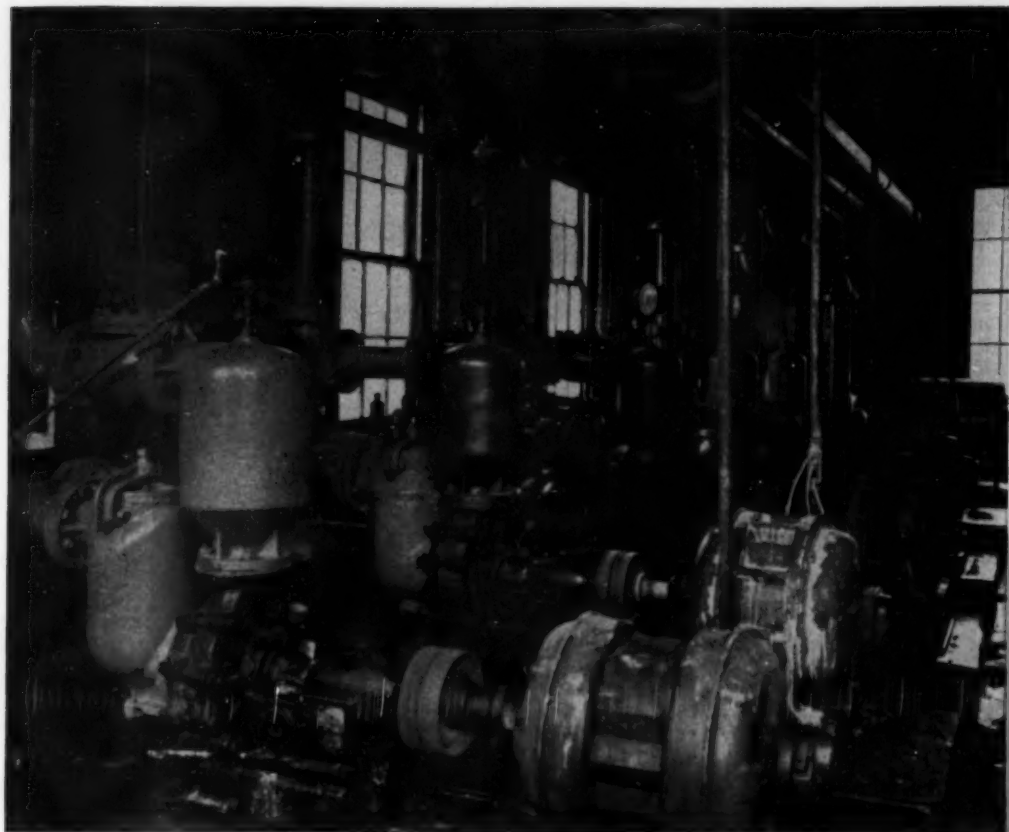
## CHICAGO BRIDGE & IRON COMPANY

Atlanta 3.....2120 Hooley Bldg.  
Birmingham 1.....1510 North Fifth St.  
Boston 10.....1005-201 Devonshire St.  
Chicago 4.....2124 McCormick Bldg.  
Cleveland 15.....2220 Goldthall Bldg.

Detroit 26.....1503 Lafayette Bldg.  
Houston 2.....2103 National Standard Bldg.  
Los Angeles 17.....1505 General Petroleum Bldg.  
New York 6.....3318-165 Broadway Bldg.  
Philadelphia 3.....1625-1700 Walnut St. Bldg.

Salt Lake City 4.....505 West 17th South St.  
San Francisco 4.....1522-200 Bush St.  
Seattle 1.....1305 Henry Bldg.  
Tulsa 3.....1623 Hunt Bldg.  
Washington 6, D. C.....Cafritz Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA



## Salting It Away

Although salt brine isn't particularly difficult to handle, this manufacturer wanted tops in dependability. So he chose LaBour for a battery of pumps that had to be on the job or else. (The "else" means here, as in so many plants, a lot of dollars lost in production, wasted material and maintenance labor.)

The LaBour pumps prime themselves quickly when necessary, cannot air bind, yet have neither

valves nor small, easily clogged fluid passages which would be vulnerable to crystal deposits. Effectiveness is in no way dependent upon close clearances, hence wear or corrosion must reach extremes before performance is noticeably impaired.

More than 28 years of service to the process industries has demonstrated LaBour dependability. You aren't guessing—or hoping—when you specify LaBour.

**ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP**

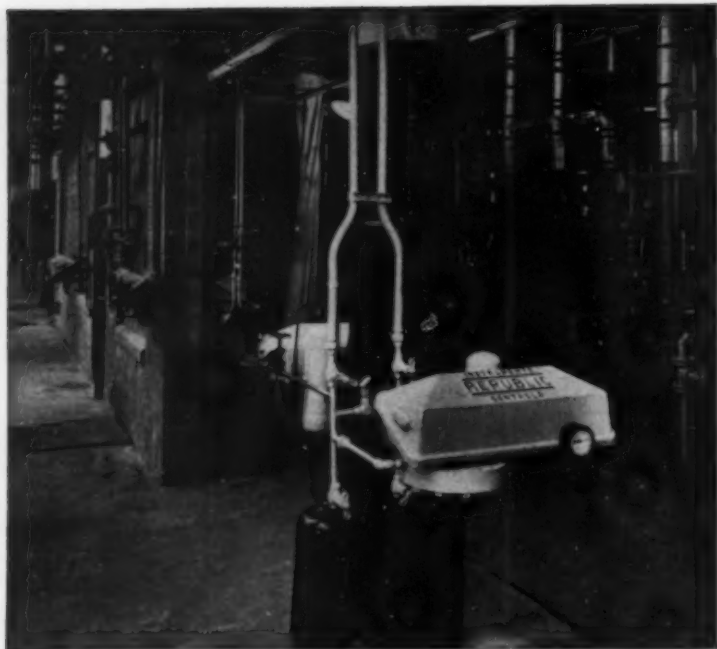
# LABOUR

**THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.**

CHEMICAL ENGINEERING—March 1951







## **These Meters Had To Be ACCURATE — FLEXIBLE — RUGGED**

One hundred twenty one Republic Pneumatic Transmitters are measuring the flow and level of various acids in a large chemical processing plant, a section of which is pictured above.

These transmitters have a guaranteed accuracy of within  $\frac{1}{2}$  of 1% of the transmitter range. By making a few minor adjustments or substituting a few small parts, their operation can be easily changed to any desired range between a minimum of 0—0.6" of water to a maximum of 0—704" of water. Their construction is more like that of a precision machine than of the sensitive instrument they are. It is for these reasons that Republic Pneumatic Transmitters, even though comparatively new, have already

been specified and installed on over 2500 industrial metering applications.

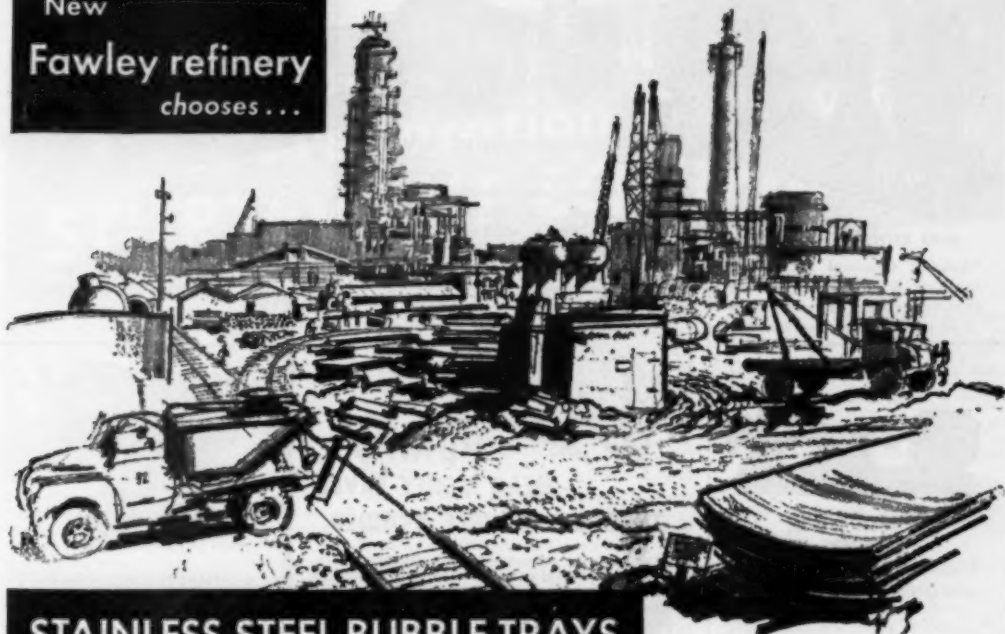
Republic Pneumatic Transmitters are available for measuring flow, liquid level, pressure or liquid density of a wide range of fluids. They employ the force-balance principle to convert these process variables into air pressures which vary proportionally. These air pressures become direct measurements and can be conducted to reading instruments or used as the measuring impulse for the actuation of an automatic controller.

Data Book No. 1001 contains complete details on the construction and operation of Republic Transmitters. Write for your copy today.

**REPUBLIC FLOW METERS CO.**

2240 Diversey Parkway, Chicago 47, Illinois

New  
Fawley refinery  
chooses...



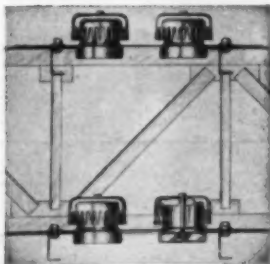
## STAINLESS STEEL BUBBLE TRAYS

by Gilbarco

**EUROPE'S LARGEST REFINERY**—At Fawley, England, Gilbarco Bubble Trays will help make possible a daily crude oil processing capacity of more than 100,000 barrels.

**GILBARCO'S new alloy BUBBLE TRAYS offer all these refinements for refining**

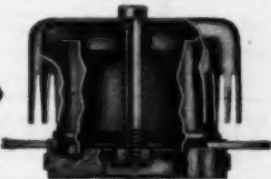
- **ADVANCED DESIGN**—Greater resistance to loading deflection. Increased accessibility to all tray levels. Greatly reduced joint leakage, minimum packing.
- **EASILY CLEANED**—Flush chimney mounting holes. One-man top-side removal of bubble caps. The inherent resistance to adhesion of smooth alloy metals.



### "DUO-LEVEL" TRUSSES and IMPROVED BUBBLE CAPS

**TWO TRAYS** are supported by a common truss in the longer spans—means greater rigidity with lighter weight. Access for cleaning, inspection, or replacement is far easier.

**BUBBLE CAPS**—new design permits quick, easy removal by one man working from top side. There are no flanges or projecting edges around holes to slow up cleaning operations.



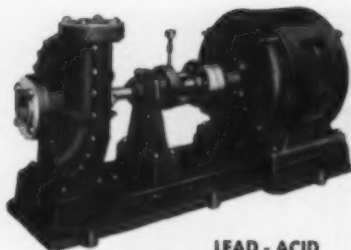
#### AVAILABLE IN ALL LIGHTWEIGHT METALS—

Gilbarco with its large staff of experienced engineers stands ready to fulfill the needs of your process design.

*Gilbarco*

**GILBERT & BARKER  
MFG. CO.**

West Springfield, Mass.—Toronto, Canada  
Established in 1865



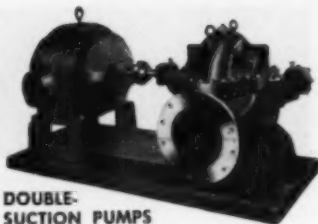
#### LEAD-ACID AND OTHER CHEMICAL PUMPS

"Buffalo" Chemical Pumps are available with lead lining like the pump shown, or rubber lined or of special alloys. Bulletin 982.



#### CLOSE-COUPLED PUMPS

A real space-saving design with no sacrifice in durability and efficiency. For clear water, but can be had in special alloys. Bulletin 975-B.



#### DOUBLE- SUCTION PUMPS

For top performance on clear water jobs, including air washers, these are of the finest materials and construction. Bulletin 955-N.



#### PAPER STOCK PUMPS

Diagonally-split-shell non-clogging pumps. A design for every liquid, every consistency, all proven in paper and pulp mills. Bulletin 953-F.

# *"Buffalo"*

## PUMPS

MEAN MONEY SAVED

THROUGH TROUBLE AVOIDED

True economy in pumping is in the pump you can install — and practically forget! "Buffalo" has always built such pumps. First cost may be a few dollars more than the "low-bidder" pump, but careful, sound "Buffalo" design and construction has always paid for itself in (1) longer years on the job, (2) fewer and shorter shutdowns, and (3) high efficiency.

As the pictures on this page show, you can pick a "Buffalo" Centrifugal Pump that's tailor-made for just about any liquid job you have. WRITE FOR BULLETINS!

### BUFFALO PUMPS, INC.

501 BROADWAY BUFFALO, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

### — And For FANS —

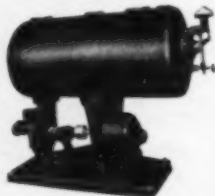
... you'll find a full line of centrifugal, axial flow and propeller fans in the sizes and arrangements you want — a fan for every job! For best results on your next fan installation, look to "Buffalo". . . First For Fans. For complete information, write:

### BUFFALO FORGE COMPANY

501 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities



#### AUTOMATIC CONDENSATE PUMPS AND RECEIVERS

Will handle condensate at 212° F. without being affected in any way. Self-priming and trouble-proof. Bulletin 960-G.



#### SUMP PUMPS

Self-contained vertical units ready to install.

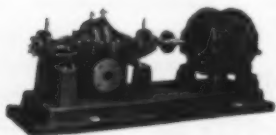
Rugged, trouble-free, with ball-bearing thrust and enclosed shaft.

Bulletin 963-F.



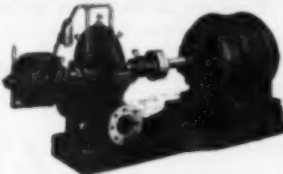
#### NON-CLOGGING SEWAGE PUMPS

Vertical and horizontal models for trouble-free operation in sludge circulation, agitation and removal, in lift stations and treatment plants. Bulletin 964-D.



#### TYPE "RR" PUMPS

For handling clear water, any temperature, at high pressures. Widely used for boiler feed. Rugged, efficient. Bulletin 980-B.



#### SELF-PRIMING PUMPS

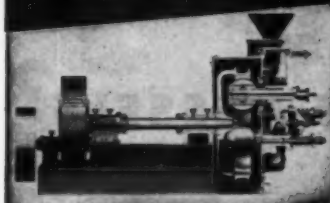
Positive prime is maintained at all times. A popular feature available in all "Buffalo" Double Suction Pumps. Bulletin 970-A.



#### SPECIAL ALLOY PUMPS

Single suction, full ball bearing pumps, suitable for construction in most machineable alloys. Bulletin 982.

# Step-up Production Lower Preparation Costs with STURTEVANT EQUIPMENT



**RING ROLL MILL** — for medium and fine reduction of hard or soft materials (10 to 200 mesh). Open-door accessibility for easy cleaning. Available in many sizes and capacities.



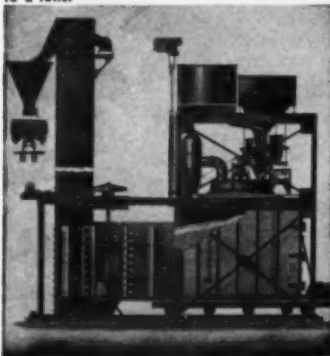
**TAILINGS ROTARY PULVERIZER** — increases output of fertilizer tailings . . . will not clog . . . leaves no daily accumulation of onground pellets. Capacities up to 25 tons per hour.



**DRY BATCH MIXERS** — 4-way mixing action mixes two or more ingredients into an inseparable, homogeneous mass. Open door accessibility makes cleaning easy. Capacities  $\frac{1}{4}$  ton to 2 tons.



**MOTO-VIBRO SCREENS** — screen everything screenable. Open and closed models with or without feeders. Many types and sizes . . . screens from  $\frac{1}{8}$ " to 60 mesh.



**DENS AND EXCAVATOR** — speeds processing of superphosphates. Easily operated by two men . . . produces 16 to 40 tons per batch and up to 480 tons per day of superior fertilizer free from lumps.



**AIR SEPARATOR** — for finest separation of materials. Capacities from  $\frac{1}{4}$  ton to 50 tons per hour in fineness of 40 to 325 mesh and finer. Increases production of fines, cuts power consumption costs.

Sturtevant Processing Equipment . . . Grinders, mixers, separators, screens, etc. . . can help you *reduce* today's high manufacturing costs by increasing both machine and operator output, lowering production costs, assuring high quality products.

Records in all types of industries — chemical, plastics, ceramics, cement, food, construction — prove that this equipment works dependably day in, day out with little, if any, maintenance.

Used individually or linked together in proper sequence, they do the job faster and easier than other types . . . handle a larger variety of work.

It will pay you to investigate Sturtevant Processing Equipment for your plant. There is a size and type of machine that will meet your requirements. Write for information.

## STURTEVANT MILL COMPANY

100 CLAYTON STREET  
BOSTON 22, MASSACHUSETTS  
Designers and Manufacturers of:  
CRUSHERS • GRINDERS • SEPARATORS  
CONVEYORS • MECHANICAL DENS  
and EXCAVATORS • ELEVATORS  
MIXERS

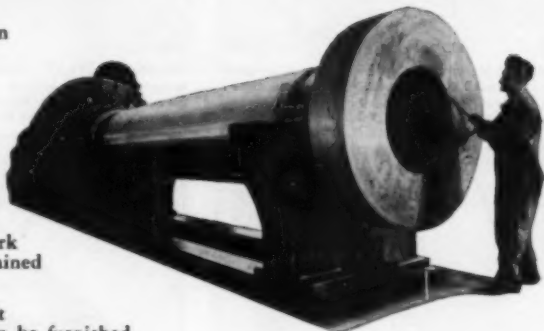


## What's the *BEST* Feature of BETHLEHEM PRESSURE VESSELS?

That question, put to several different customers, might well draw several different answers. Our own would be this: the careful, painstaking workmanship, the attention to detail, that assures the purchaser of a job well done.

In the building of forged pressure vessels, we draw upon a fund of experience that began many years ago. It guides us in the making of fine steels, and the forging of these steels to the required shapes and dimensions. It enables us to choose the right heat-treating cycles, the best machining methods. It helps make possible the work of our seasoned metallurgical staff and the other trained specialists who know what they're doing and why.

Bethlehem forged-steel pressure vessels can be built in virtually any size and type you name. They can be furnished as single or multiple units with any desired wall thickness. When you require vessels for high-pressure work in the chemical, rubber, petroleum, fertilizer, food-processing or allied industries, call Bethlehem. We are equipped to do expert work for you.



**BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.**

*On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation*





THIS STATEMENT BY THE  
CHICAGO PNEUMATIC  
TOOL COMPANY  
SPEAKS FOR ITSELF



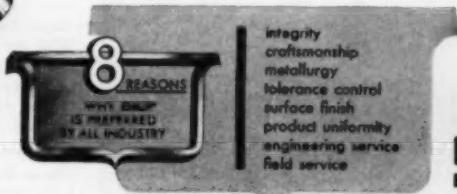
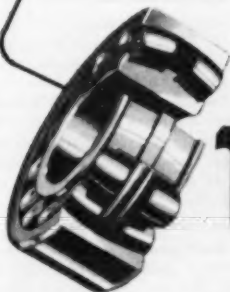
"The Class O-CE Chicago Pneumatic Horizontal Duplex Motor-Driven Compressor is the first to have anti-friction roller bearings throughout. This big advancement in compressor design utilizes **SKF** Spherical Roller Main and Crankpin Bearings . . . this innovation in side-crank compressor design is made possible by **SKF**'s recent development of the Oil Injection Method of bearing installation and removal.

"With anti-friction bearings many advantages are evident. Reduced maintenance time and costs, one-piece connecting rods and crank discs, a flood lubrication system and no possibility of improper bearing adjustments are among these."\*

Once again **SKF**, by helping put the right bearing in the right place, has contributed to the engineering of more efficient equipment designed to give more dependable and economical service.

7212

\* For detailed information on Chicago Pneumatic Tool Company Compressors and other equipment write Chicago Pneumatic Tool Company, 6 E. 44th Street, New York 17, N. Y.



**SKF**  
BALL AND ROLLER BEARINGS

**SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.**  
—manufacturers of **SKF** and HESS-BRIGHT bearings.

# Jefferson

... hallmark of  
high quality  
chemicals  
from hydrocarbon sources

The quality of Jefferson chemicals is achieved as a result of close chemical control at every step of the manufacturing process.

Regardless of the pressure of production, regardless of the stress of new demands, you can be sure that such quality will be maintained for your protection.

A request on your company letterhead brings you full information on our available products.

## JEFFERSON ETHYLENE GLYCOL

A versatile industrial chemical for use in:

Antifreeze

Cellophane

Alkyd resins

Industrial explosives

Synthetic Fibers

Hydraulic fluids

For these and many other uses, the high purity and uniformity of Jefferson ethylene glycol meet the most exacting demands of experienced manufacturers. For details concerning prices, delivery, and specifications, write to Department G.

### Jefferson Chemical Company, Inc.

711 FIFTH AVENUE, NEW YORK 22, N. Y.



ESSENTIAL CHEMICALS FROM HYDROCARBON SOURCES

ETHYLENE OXIDE  
DIETHYLENE GLYCOL  
ETHYLENE DICHLORIDE  
ETHYLENE GLYCOL

## Briefs

### From recent literature

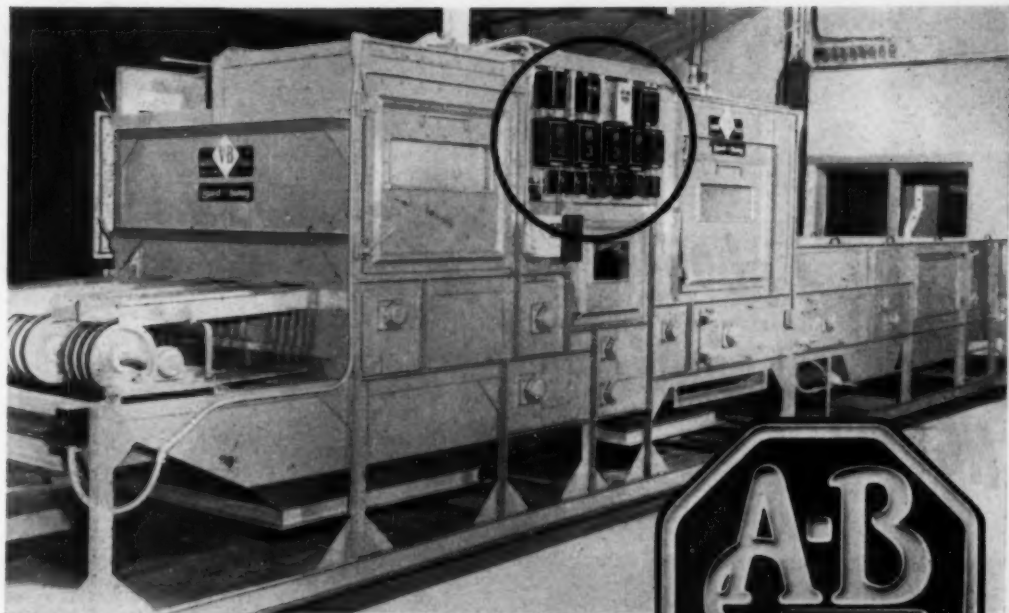
**Broke fluids** with improved characteristics can be prepared from 10% to 25% by volume of a lubricant, such as the mono- or diricinolate of ethylene glycol, and 45% to 70% by volume of a proper diluent, such as ethylene glycol. Corrosion inhibitors and other ingredients may be added in small amounts when required.

**Flameproofing** of certain papers is accomplished by using glycol mono-sulfates having a ratio of carbon to hydroxyl of between one and two. Such an agent can be prepared by reacting ethylene glycol (620 g.) with 1000 g. of concentrated sulfuric acid below 40° C. Neutralization can be carried out with an aqueous solution of a suitable base, such as ammonia or ethanolamine.

**Epoxide compositions** which convert to water-insoluble, infusible products can be prepared from one part by weight of a polyepoxide (prepared from the reaction of an epihalohydrin with a polyhydric alcohol, such as ethylene glycol, followed by dehydrohalogenation) with two-thirds to three parts by weight of a resinous epoxide (prepared by reaction of an epihalohydrin with a polyhydric phenol salt). Related products are obtained by the addition of small amounts of certain phenols to the epoxide mixture. Such epoxide compositions are valuable as organic bonding or cementing agents.

**Antirusting compositions** are conveniently prepared by reacting an anhydride of a dicarboxylic acid with a glycol, such as ethylene glycol, and with a monohydric alcohol. A further quantity of anhydride is finally condensed with this ester to produce the antirusting agent, which is particularly useful in turbine oils.

These developments are abstracted from recent publications or U. S. patents. The uses may suggest other applications of Jefferson Ethylene Glycol in your products or processes.



Special liquid honing machine made by Vapor Blast Manufacturing Company for a Pennsylvania pottery. Equipped with Allen-Bradley Bulletin 609 Manual Starters, Bulletin 709 Automatic Starter, Bulletin 700 Relays, and Bulletin 800 Push Buttons.



### Typical Allen-Bradley Motor Controls



Bulletin 609 Size 0  
Manual Starter in Gen-  
eral Purpose Enclosure.  
Reliable. Trouble free.



Bulletin 709 Size 1  
Solenoid Starter in  
General Purpose En-  
closure. Easy to wire.



Bulletin 709 Solenoid  
Starter in an enclosure  
for hazardous dust lo-  
cations. Overload re-  
lays are easily reset.



Bulletin 709 Solenoid  
Starter in a watertight  
and weatherproof cast  
iron enclosure. Rubber  
gasket seal.



Bulletin 800 two  
button, standard  
duty, push button.  
One of a broad  
line of push but-  
tons and airtight  
control stations.

### TROUBLE FREE

### A-B MOTOR CONTROLS for LIQUID HONING MACHINE

This liquid honing machine, made by Vapor Blast Manufacturing Company, puts a smooth surface on pottery. It is equipped with dependable Allen-Bradley motor controls. Bulletin 709 solenoid starters provide dependable overload protection and no-voltage protection. Only one moving part means millions of trouble free operations. Bulletin 609 starters are manually operated with two buttons—START and STOP—which actuate the switches with quick make, quick break action. A safe enclosure is available for every application . . . wet, hazardous, dusty, corrosive.

Allen-Bradley motor starters have double break, silver alloy contacts which are maintenance free—they do not require inspection—a time- and moneysaving feature in starters with bolted enclosures. Dependable overload relays are reset without opening starter cabinet. Call nearest Allen-Bradley engineer, today.

ALLEN-BRADLEY CO.

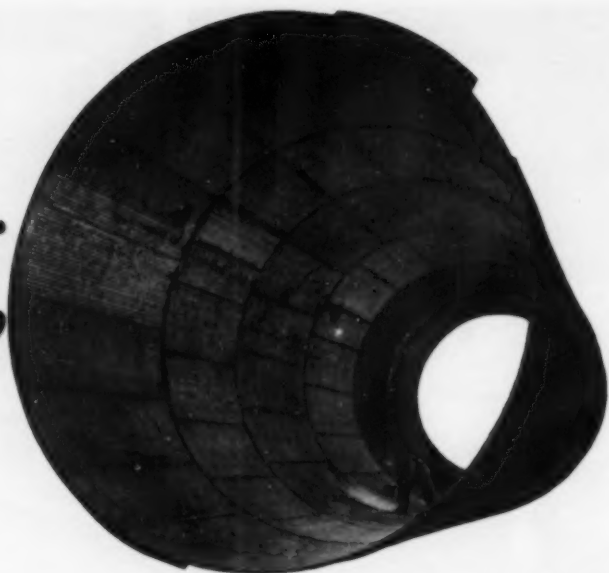
1337 S. First Street

Milwaukee 4, Wisconsin

# ALLEN-BRADLEY SOLENOID MOTOR CONTROL

QUALITY

**Worried about  
HCl corrosion?**



Monel-lined top section of a large fractionating column. Made by the A. O. Smith Corporation for one of the nation's largest oil refiners.

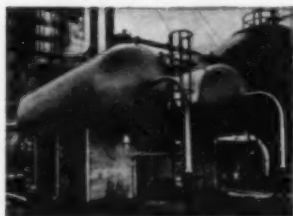
Many years of service experience backed by extensive research, have shown that Monel® has satisfactory resistance to destructive corrosion by hydrogen chloride and hydrochloric acid.

In applications where low concentrations of hydrochloric acid must be handled regularly, Monel vessels and processing equipment have given outstanding service. In petroleum refining, for example, Monel-lined fractionating columns, tanks, and Monel piping and fittings have substantially outlasted other metals.

In addition, Monel is an excellent structural material, possessing high strength, and good workability. Monel can be welded to form corrosion-resistant joints; can be machined, formed, and bent with ordinary shop tools and methods.

• • •

Monel, like other Nickel alloys, is in short supply. However, in planning for the future or for equipment vital to Defense, it is suggested that you consult our Corrosion Engineering Service on any questions regarding corrosion-resisting materials.



Monel-lined tanks installed at the plant of a large Southern oil refiner. Tanks are lined with Monel to combat corrosive action of dilute hydrochloric acid.

The tanks were fabricated by Wyatt Metal & Boiler Works, Houston, Texas.

EMBLEM OF SERVICE  
**NICKEL INCO ALLOYS**  
TRADE MARK

MONEL • "K" MONEL • "R" MONEL • "KR"  
MONEL • NICKEL • "D" NICKEL • "L" NICKEL  
INCONEL • DURANICKEL • PERMANICKEL  
INCONEL "X"

**THE INTERNATIONAL NICKEL COMPANY, INC.**  
67 Wall Street, New York 5, N. Y.

# where are your \$ \$ \$'s?

**in the liquid phase, or  
in the solids phase of the slurry?**

The Sharples Super-D-Canter is a centrifuge developing high centrifugal force (2100 x g) which makes it possible continuously to:

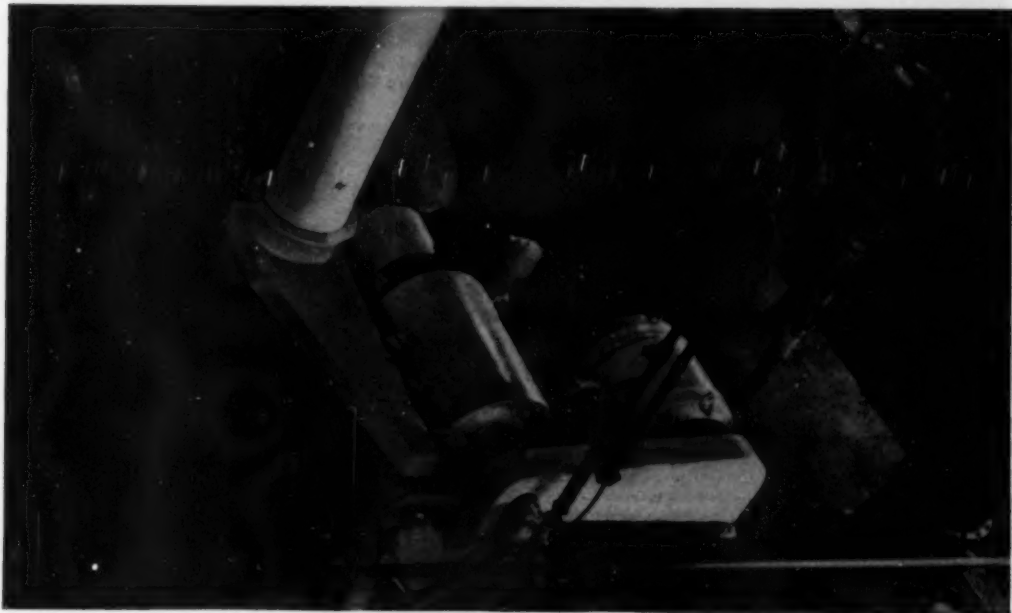
1. Recover and dewater crystalline type solids
2. Remove amorphous solids from suspensions
3. Classify solids by particle size
4. Clarify liquids
5. Rough out prior to final clarification or separation

In the typical installation below, the Super-D-Canter

efficiently removes undesirable solids from the valuable liquid, with minimum loss of mother liquor. In many other cases valuable solids are removed from useless liquids; or, both usable solids and liquids are separated.

Slurries containing from 1% to 20% or more solids can be handled by the Super-D-Canter, with solid particles from 1/2" down to several microns in size. Both solids and liquids are discharged continuously.

The Super-D-Canter is doing a big job around the world. Get the facts in Bulletin 1254.



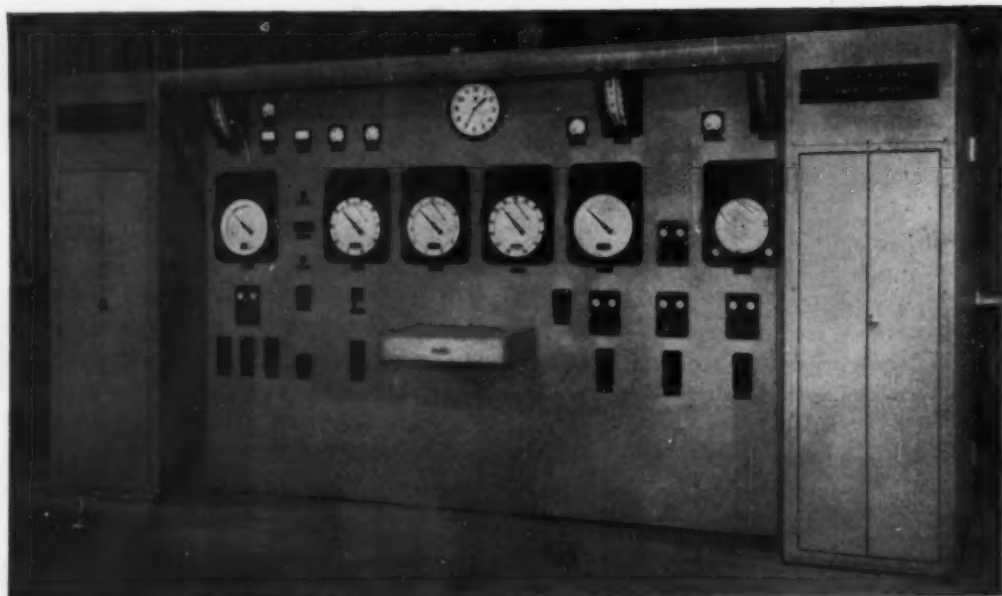
*Super-D-Canter in chemical processing at Hooker Electrochemical Company, Niagara Falls, N. Y.*

## **SHARPLES**



THE SHARPLES CORPORATION • 2300 WESTMORELAND STREET, PHILADELPHIA 40, PENNA.  
NEW YORK • BOSTON • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON





Main Panel Board for control of 3000 bbl per day Kiln  
at Missouri Portland Cement Company, St. Louis, Missouri.

*3 Ways  
Better*

## ...Bailey Control for Rotary Kilns

Bailey Control for Rotary Kilns gives you better performance three ways:

1. Economical Operation
2. Uniform Quality of Product
3. Reduced Maintenance

These are advantages which can be achieved when all phases of kiln operation are coordinated to work together as a team. Here's how Bailey Kiln Control can help you get all three.

### ECONOMICAL OPERATION

With Bailey Combustion Control you can be certain that you are getting maximum product for every unit of fuel you burn. Bailey Control closely guards the Fuel-Air Ratio, Hood Draft, Fuel Feed, Clinker Cooling and the Temperature of Air for Combustion.

### UNIFORM QUALITY OF PRODUCT

Bailey Instruments and Controls can help you achieve a

uniform high grade product. Measurements of temperatures, kiln speed, combustibles content, and oxygen content can be transmitted to recorders on centrally located control boards like the one shown. There is no sacrifice of accuracy or speed of response. High temperature alarm contacts may also be provided with Bailey Pyrometers as a further aid in achieving optimum uniformity of product.

### REDUCED MAINTENANCE

By maintaining uniform temperatures and excess air conditions in the kiln, Bailey Controls help to reduce to a minimum costly refractory repairs and wear and tear on auxiliary equipment.

Bailey Meter Company has a staff of engineers who are experts in the control of rotary kilns. Assure yourself of optimum kiln performance. Let one of these men help plan your Kiln Control System.

P-22

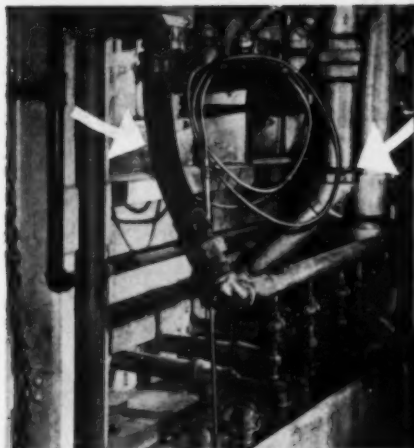
## BAILEY METER COMPANY

1054 IVANHOE ROAD

CLEVELAND 10, OHIO

*Controls for Processing*

TEMPERATURE  
PRESSURE  
% OXYGEN  
% COMBUSTION  
FLOW  
LEVEL  
DENSITY  
RATIO



## Carries Fire and Water

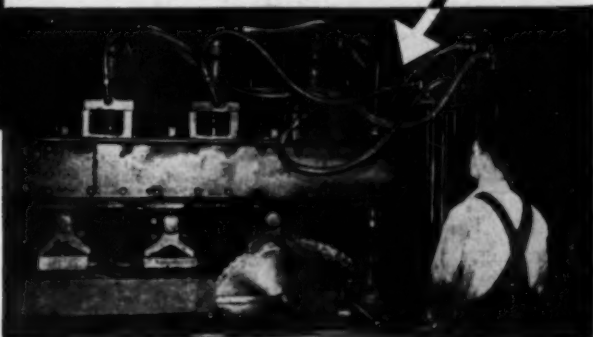
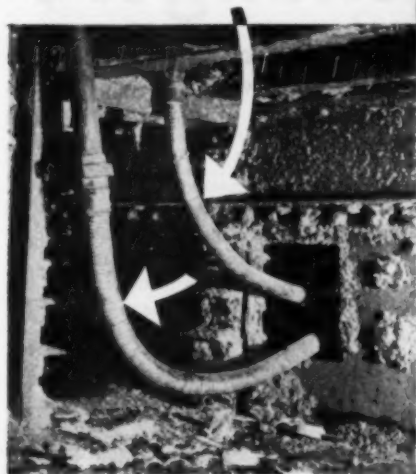
This coil of American Flexible Metal Hose feeds gas to torch for lighting annealing furnace burners. It replaced nonmetallic hose which rapidly deteriorated. Large section of hose in foreground carries coolant water to furnace heater, compensates for pipe line misalignment and expansion.

## Permits Bigger Bite

Originally, swing joints connected 600 p.s.i. hydraulic lines to platens for holding metallic billets during shearing on this machine. But swing joints limited travel for billet size adjustments. Now American Flexible Seamless Bronze Tubing lets machine take maximum bite.

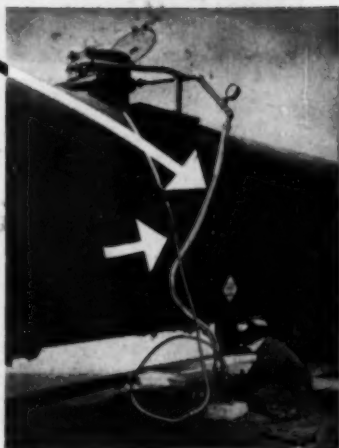
## Ignores Molten Metal

Only metal hose like this American Flexible Interlocked Bronze Hose can ignore regular splashings by molten casting metal. These carry supply and return water at 150 p.s.i. for cooling casting molds.



## Makes Unloading Easy

American Seamless Flexible Metal Tubing makes unloading this car of liquid propane easy. Propane vapor at 125 lb. pressure is pumped into tank car through combination  $\frac{3}{4}$  in. and 1 in. flexible metal tubing; forcing out propane liquid through 2 in. flexible tubing connection between dome and storage tank lines. American Seamless stands wear, makes car-spotting simple.



**let it help you.** American Flexible Metal Hose or Tubing can simplify your product or operations wherever flexible connectors are needed: for piping or ports that move, vibrate or are out of alignment; for carrying almost any liquid, gas or semi-solid. American Flexible Metal Hose and Tubing are tight, strong and corrosion-resistant.

Bulletins SS-50 and CC-300 contain information you ought to have about these versatile products. For your copies, just write The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

wherever connectors must move...

# American



FLEXIBLE METAL HOSE AND TUBING

# Dirty Water can't "Shut-down..."



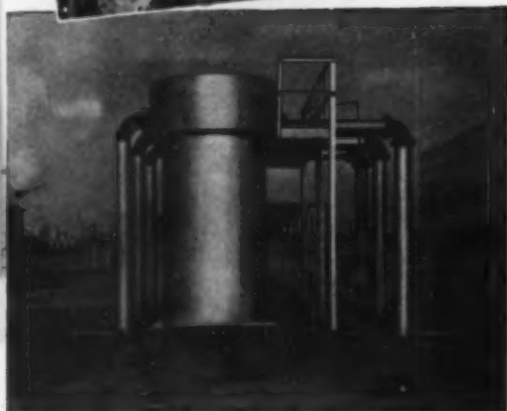
# Vogt



## film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned while in operation!* The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

**TOP:** Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.

**BOTTOM:** Jacket Water Coolers serving engines of 7,500 HP in the compression plant of a Western Oil Refinery.



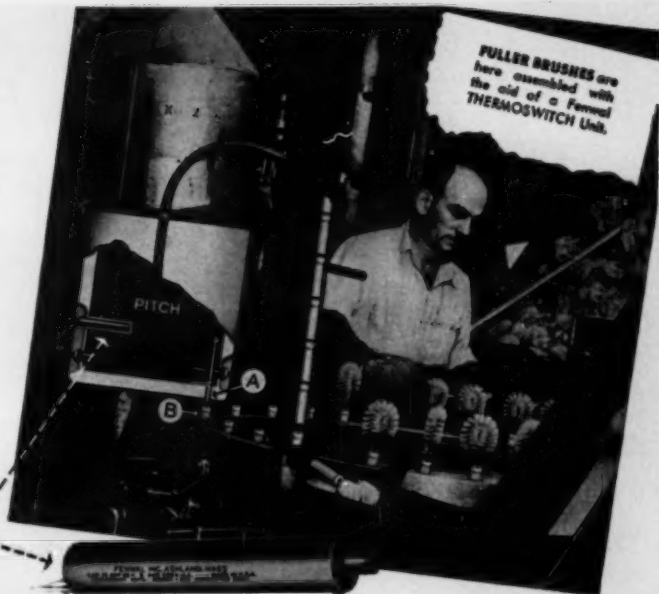
[ Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request. ]

### HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA,  
ST. LOUIS, CHARLESTON, W. VA.

# Multi-Purpose Thermostat solves problem in Fuller Brush assembly— prevents damage to machinery, motor

**INVERSE CARTRIDGE THERMOSWITCH UNIT #17001** which closes on temperature rise is inserted in well inside of pitch tank and connected in series to starting switch and magnetic contactors. Machinery operates only when pitch has reached the preset temperature that assures fluidity. It then moves through automatically operated spout (a) into hollow brush handle (b).



When vegetable brushes are assembled at the Fuller Brush plant, a pitch-like sealing compound is poured into the hollow handle of the brush. The brush is then inserted in the handle and completed brush moved on to packing room.

Trouble-point in this procedure was the sealing compound. If it were not heated to a fluid state before machinery was started, automatic spout was broken and motor burned out.

A low-cost Fenwal THERMOSWITCH Unit averted this stoppage by continually, accurately controlling the operation of the motor. Electric motor cannot now start until the compound has reached the desired temperature. Thus damage to machinery as well as motor is prevented.

Easy-to-install, easy-to-maintain Fenwal THERMOSWITCH thermostats solve all types of control problems in industry. Their activating control element is the single-metal shell that expands or contracts *instantaneously* with tempera-

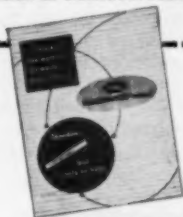
ture changes, making or breaking the totally enclosed electrical contacts. It is this unique principle that enables THERMOSWITCH Units to effectively control many variables where heat is a factor.

Mail the coupon today and find out how Fenwal THERMOSWITCH Controls can help you in your own processing.

**Fenwal**

**THERMOSWITCH®**

The Precision, Multi-Purpose, Thermostat Control  
**SENSITIVE...but only to heat**



**FREE!**

Get this bulletin . . . see what  
Fenwal THERMOSWITCH Units can  
do for you. Just fill in coupon and mail  
...no obligation.

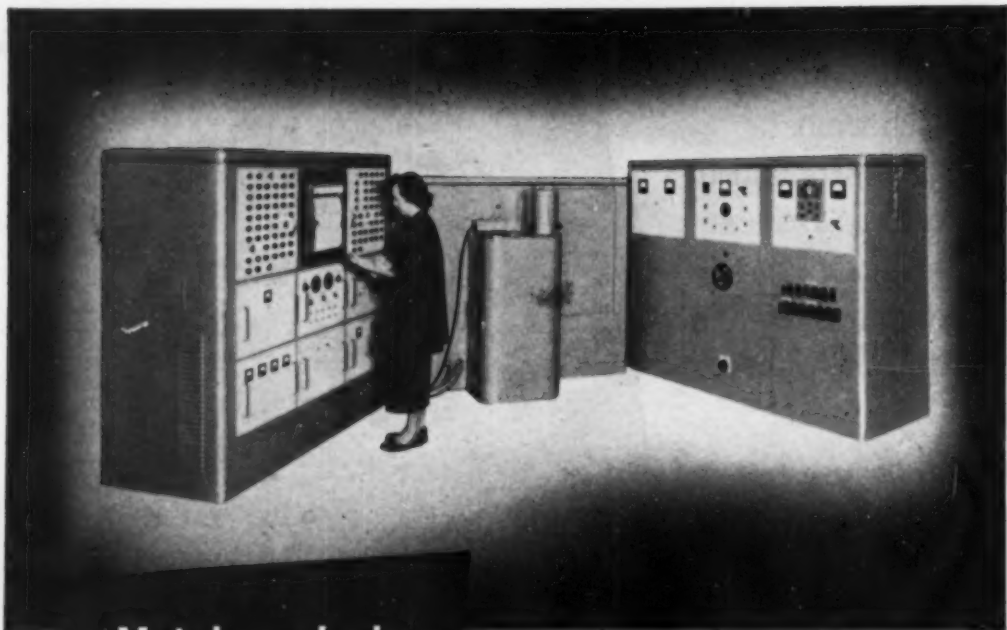
FENWAL, INCORPORATED, 163 Pleasant St., Ashland, Mass.  
111 South Burlington Ave., Los Angeles 4, Cal.  
TEMPERATURE CONTROL ENGINEERS

Name.....Position.....  
Company.....  
Street.....  
City.....Zone.....State.....

I am chiefly interested in the applications checked:

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Heating                                     | <input type="checkbox"/> Timing (thermal)              | <input type="checkbox"/> Pressure Control (by controlling vapor temperature) |
| <input type="checkbox"/> Cooling                                     | <input type="checkbox"/> Humidity Control or Detection |  |
| <input type="checkbox"/> Alarm (over-temperature, under-temperature) | <input type="checkbox"/> Vapor Level Control           | <input type="checkbox"/> Radiant Heat Control                                |

OTHER (Please fill in your special requirements)



## Metal analysis in 2 minutes...

with ARL Production  
Control Quantometer

### Leader in Performance

*No other instrument in this field offers you so many outstanding features for obtaining complete, accurate, high-speed chemical analyses.*

### Leader in Popularity

*ARL Production Control Quantometers are in daily use in all fields of metal analysis.*

Representing the most advanced type of direct-reading spectrometer yet developed, this multiple-purpose instrument provides pen-and-ink recorded analyses of samples, element by element, almost instantaneously. These graphic records may be made in multiple for high-speed analytical control.

The instrument can be designed for many purposes, including testing of metal alloys and other inorganic materials. As many as 25 elements can be measured with one instrument—up to 20 simultaneously. Individual units are not limited to one type of analysis but can be designed for diverse and versatile service to meet the requirements of several major plant problems. Results are comparable to chemical analyses in accuracy.

The latest and most elaborate unit in the complete ARL line of spectrochemical equipment, the ARL Production Control Quantometer offers the modern scientist the equivalent of a complete laboratory in one compact unit. Manufactured by the world's oldest and largest producers of direct-reading instruments, the Quantometer is available to help you in your analytical and production problems. Write for complete details.



### APPLIED RESEARCH LABORATORIES

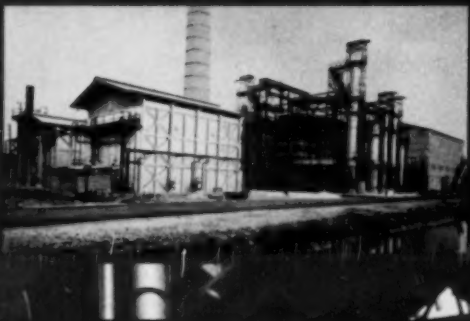
4336 San Fernando Road, Glendale 4, California  
New York, Pittsburgh, Detroit, Chicago, Los Angeles



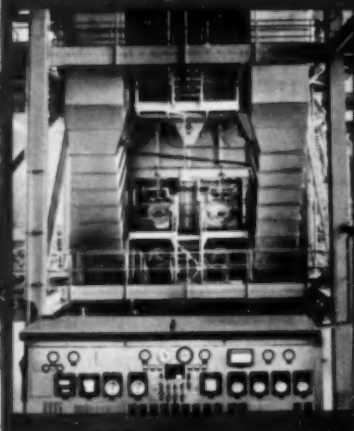


**the complete engineering service**

**complete lube oil processing plants**



**dual-circulation  
steam generators**



**complete chemical plants**



**FOSTER WHEELER CORPORATION**

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**Complete Oil Refineries  
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**Steam Generators in any capacity.  
Condensers . . . Evaporators  
Feedwater Heaters . . . Cooling Towers  
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**steam generators**

**Sulfur Recovery. Edible Oil Treating  
Fatty-Acid Fractionating Units . . .  
All types of DOWTHERM systems . . .**

**industrial processes**

**the complete  
engineering and construction  
service**

**anywhere in the world**

**FOSTER WHEELER CORPORATION**

30 ROCKAWAY, NEW YORK 9, NEW YORK

# ORONITE POLYBUTENES

*help make a variety of products better*

Oronite Polybutenes have been tried and proven in many applications. They are produced in selected grades of viscosity, carefully engineered and application tested to meet exacting requirements. Broad scale use of these products attests to the ability of Oronite to combine quality and quantity in the production of basic ingredients for better products.



*A partial list of  
other Oronite Chemicals*

#### NOTICE

Some of the following,  
including the Polybutenes,  
are currently in short supply.

Detergent Alkane  
Detergent Slurry  
Detergent D-40  
Detergent D-60  
Wetting Agents  
Lubricating Oil Additives  
Cresylic Acids  
Gas Odorants  
Sodium Sulfonates  
Purified Sulfonate  
Naphthenic Acids  
Phthalic Anhydride  
Ortho Xylene  
Para Xylene  
Xylol  
Aliphatic Acid  
Hydroformer Catalyst

## Here are 3 major uses for Oronite Polybutenes

### MOLDED RUBBER SPECIALTIES

As plasticizers and softening agents, Oronite Polybutenes increase tear resistance, improve molding characteristics, inhibit bloom and aid pigment dispersion in a wide variety of molded rubber products... (in everything from garden hose to noise and vibration insulation compounds and hot water bottles).



### ADHESIVES

Oronite Polybutenes contribute outstanding adhesive and tackiness properties to industrial and surgical tapes, and label adhesives. Used either in natural form or in emulsions, they aid stability and add to moisture resistance.



### ELECTRICAL INSULATION

Because of their high dielectric strength and low power factor, Oronite Polybutenes are excellent impregnating agents for paper insulation. These polybutenes are stable and tacky and are resistant to moisture and oxidation.



## ORONITE CHEMICAL COMPANY

10 SARDINE STREET, SAN FRANCISCO 4, CALIF.    STANDARD OIL BLDG., LOS ANGELES 16, CALIF.  
30 DOCKTOWER PLAZA, NEW YORK 20, N.Y.    600 S. MICHIGAN AVENUE, CHICAGO 5, ILL.  
824 WYTHAM BLDG., NEW ORLEANS 12, LA.

# BAKER PLATINUM LABORATORY WARE



Our ware is subjected to the same rigorous tests which could be applied to any material. These tests are those to which our platinum laboratory ware is subjected. The tests are continuous and we maintain and operate large scientific laboratories and naturally employ our own laboratory staff in them.

The consequence is that any divergence from our high standards, any defect in manufacture, would show up inevitably.

All this makes it doubly safe for you to adopt Baker Laboratory Ware as standard equipment. You can't possibly go wrong in choosing it.

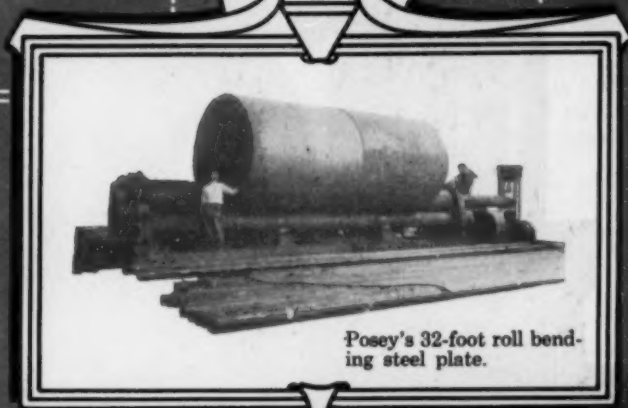
**BAKER & CO., INC.**

113 Astor St., Newark 5, N. J.

NEW YORK 7

SAN FRANCISCO 2

CHICAGO 2



Posey's 32-foot roll bending steel plate.



Divisions: Brick Machinery...  
Foundry... Industrial Heat-  
ing... Iroquois... Shipbuild-  
ing... Steel Plate.

## How Posey's "Production Picture" Fits in with Your Blueprints (and Delivery Schedules)

Today, more and more engineers are asking two questions about supply sources for steel plate construction. (1) "Have they the design experience needed to originate (or help to originate) practical blueprints?" (2) "Is their plant sufficiently adequate to assure reasonable delivery?"

Located in Lancaster, Pa.—a railroad and highway center—the plants of the Posey Iron Works cover an area of 16½ acres under roof. All have been recently modernized.

Years of practical experience have taught Posey engineers to study each specific application with an eye to economies and increased efficiency... to eliminate unnecessary steps of construction.

Steel plate construction deliveries unreasonably slow? Why not check with Posey?

# POSEY IRON WORKS, Inc.

STEEL PLATE DIVISION

LANCASTER, PA.

TANKS... STRUCTURES... GENERAL STEEL PLATE CONSTRUCTION

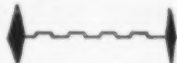




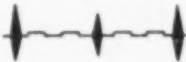
*He's looking for trouble*

#### HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.



Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.



A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to rigid state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

## GRINNELL

WHENEVER PIPING IS INVOLVED



GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago  
Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York  
Oakland • Philadelphia • Pacatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



With  
Esso  
Solvents  
multi-storage availability  
is assured too!

**STORAGE FACILITIES and WATER TERMINALS** in industrial centers give added convenience to the users of Esso Solvents. Shipments are made to meet users' requirements... by tank cars, tank trucks or drums. Specify Esso Solvents for dependable, convenient delivery right to your door!

**YOU GET ALL 6 OF THESE IMPORTANT FEATURES WITH ESSO SOLVENTS**

1. **Multi-storage availability** — water terminals in industrial centers.
2. **Uniformity** — made in modern refineries from carefully selected crude oil sources.
3. **Economy** — A storage facility near you for low freight cost and quick delivery.
4. **Controlled evaporation** — available in a wide range of evaporation rates with precise characteristics to meet your requirements.
5. **Solvency** — Esso aliphatics and Solvenso aromatics cover both high and low solvency ranges.
6. **Modern handling methods** — separate tank storage, pumping lines, tank cars and trucks, are used throughout in all Esso Solvent handling operations.

Esso Solvents:  
versatility and  
dependability  
with controlled  
high quality.



**PETROLEUM  
SOLVENTS**

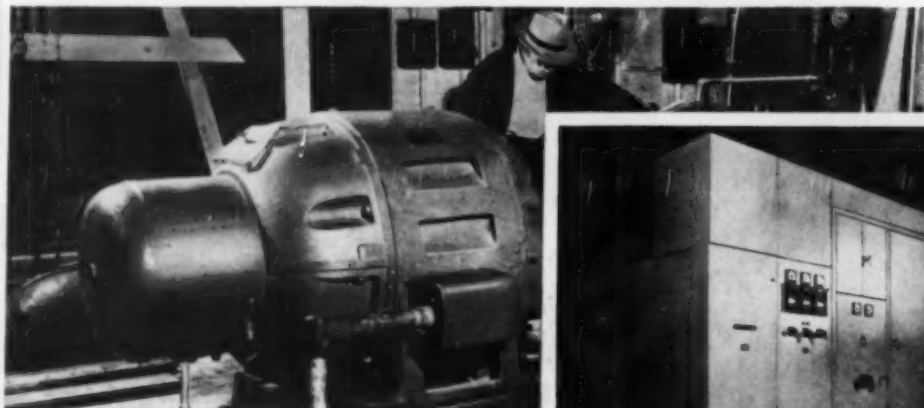
**SOLD IN:** Mo., N. H., Vr., Mass., R. I., Conn., N. Y., N. J., Pa., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

**ESSO STANDARD OIL COMPANY**  
Boston, Mass. — New York, N. Y. — Elizabeth, N. J.  
Philadelphia, Pa. — Baltimore, Md. — Richmond, Va.  
Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C.  
Memphis, Tenn. — New Orleans, La.

**DEPENDABILITY** where it counts



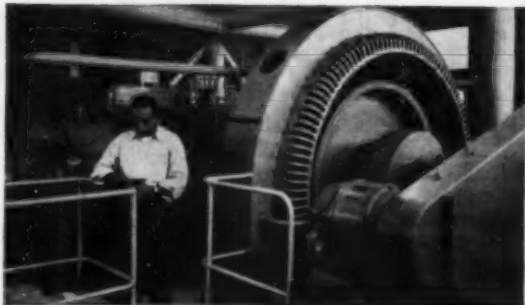
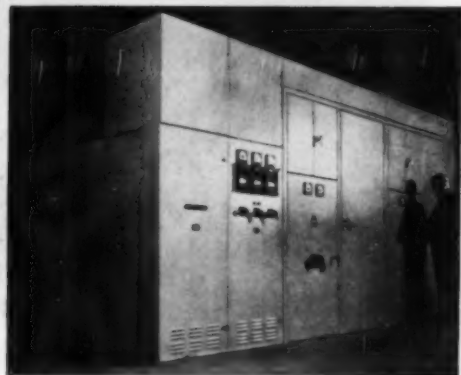
# SYNCHRONOUS MOTORS



Dependability and long life are a must in water-pumping equipment. Cohoes, N. Y. selected a G-E Tri-Clad\* 500-hp synchronous motor for their raw-water pumping station. And as protection against a short-circuit capacity of 60,000 kva, Cohoes selected G-E Limitamp high-voltage control. Besides providing accurate control for the motor, Limitamp clears shorts from the line in less than half a cycle—before damage can come to either motor or control. Ask your nearest G-E sales office for more information on Limitamp control.

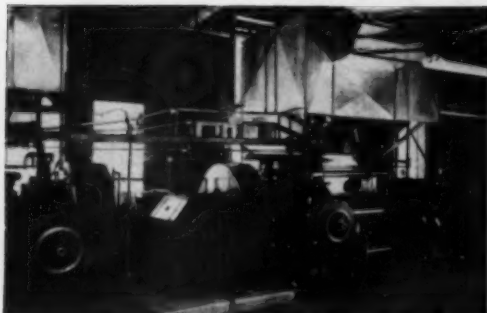
\* Reg. U. S. Pat. Off.

## ON CRITICAL PUMPING OPERATIONS

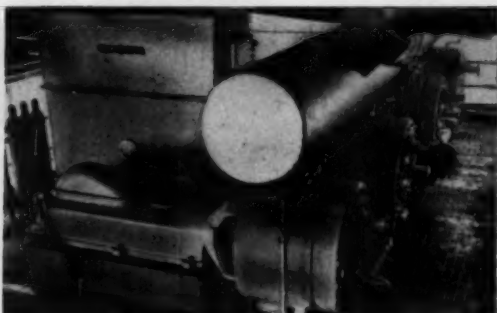


Driving compressors in gas pumping station serving hundreds of homes, motor requirements were—dependability and low cost. This G-E 1500-hp synchronous motor scores on both counts.

## FOR SPECIAL SERVICE CONDITIONS

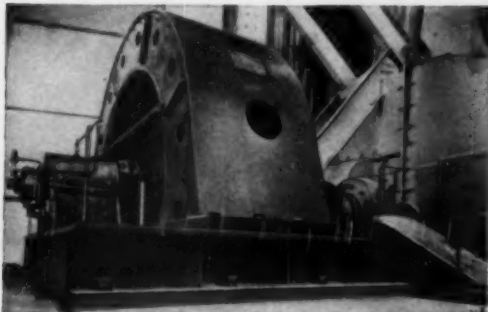


Corrosive, dust-laden atmosphere has no effect on this externally ventilated synchronous motor. Installed in a plastics mill, it's typical of the special enclosures that can be designed to meet almost any operating problem.

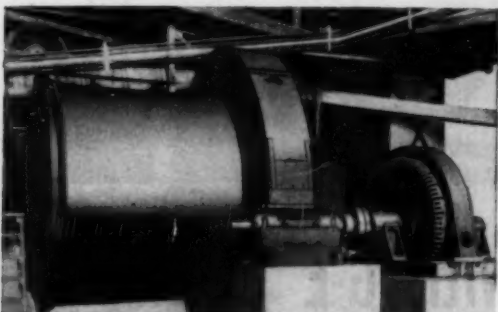


These gas compressors created a hazardous atmosphere for motor operation. The external enclosure of this 300-hp, G-E synchronous motor is filled with an inert gas to provide reliable operation.

## FOR TOUGH JOBS



A motor must be rugged to drive a large wood chipper capable of chewing 40-inch diameter logs into small pieces. This G-E synchronous motor, with rigid, box-type construction will give years of dependable service—on a tough application.



To meet the rough test of driving a ball mill, this mining company chose a G-E high-torque synchronous motor rated at 600 hp. It's given them years of dependable operation and still going strong.

## SAVE MONEY, TOO

**It's a fact . . .**

**Lower Operating Costs,**  
higher operating efficiency.

**Lower Initial Cost**  
including control and exciter—for many ratings.

**Reduced Demand**  
and release of needed generating capacity.

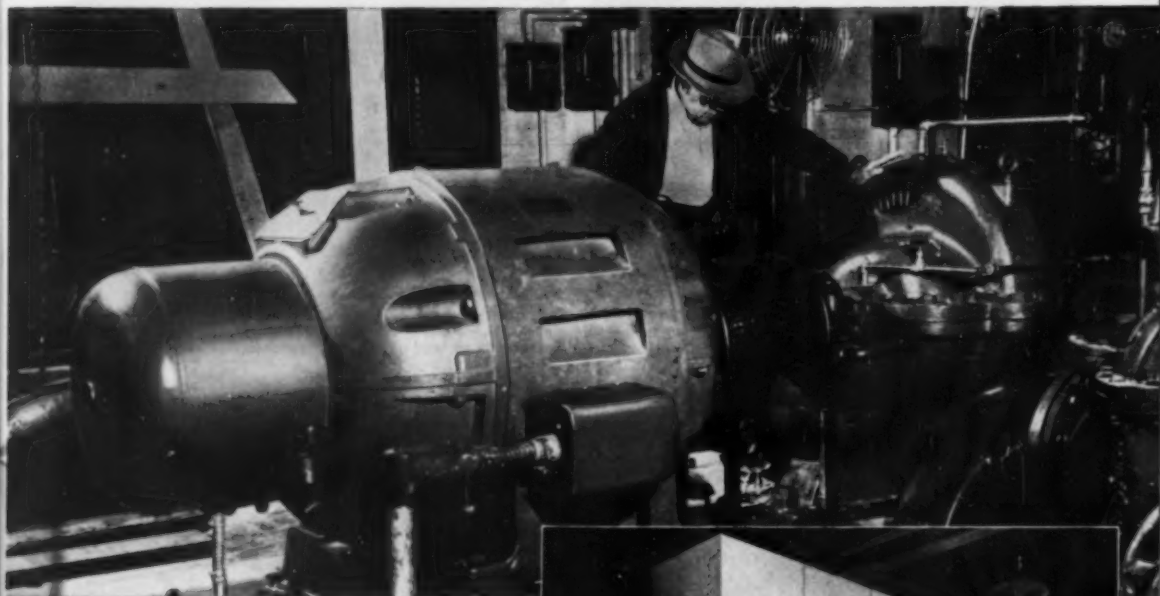
**Reduced Power Rates**  
for improved power factor.

Application engineers, with many years of field experience, will tailor G-E synchronous motors and control to your job. And, no matter where you are located, there's a G-E Service Shop near you.

For your next large, synchronous motor application, call in your General Electric representative—he'll be glad to discuss with you, your particular application. For more information on G-E synchronous motors, write for GEA-5332 (low-speed) or GEA-5426 (High-speed) to: Section 770-24, General Electric Company, Schenectady 5, New York.

*You can put your confidence in—*  
**GENERAL  ELECTRIC**

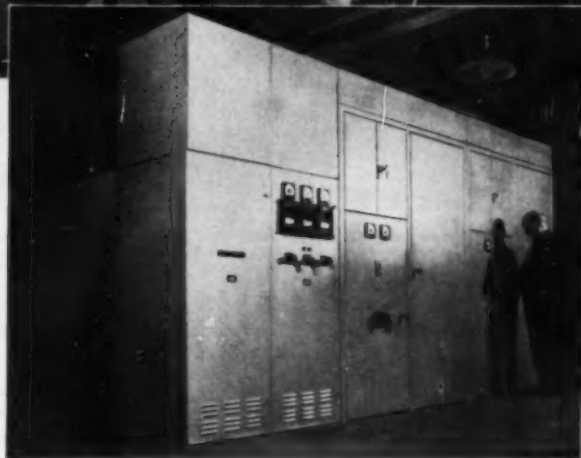
# Cohoes, N. Y. protects pumping plant equipment



## with G-E Limitamp high-voltage control

Recently, Cohoes installed a new 500-horsepower G-E synchronous motor on a raw water pump. Before they selected control the city engineers wisely decided on a complete study of the power supply. Working with the G-E sales engineer they determined the available short circuit capacity of the system was 60,000 kva. The destructive potentialities of this power obviously called for an "insurance" that would protect their investment.

**G-E Limitamp** was the "insurance". It answered every need. In addition to controlling the motor, its co-ordinated design, using current-limiting EJ-2 fuses, will clear shorts in less than half a cycle—well before damage can occur to motor or control. Extra dividends in the new smaller size, protection to personnel, reduced installation, engineering, and maintenance costs are inherent in this equipment, too.



**G-E Limitamp installed at Cohoes, N. Y. for control of two 500-horsepower motors**


**For your high-voltage installation** ask for G-E Limitamp—now available in ratings up to 4800 volts with an interrupting capacity up to 250 mva. Protect your power system and motors with G-E Limitamp—more information in Bulletin GEA-5409. Ask the nearest G-E office for this bulletin or write Section 730-23, Apparatus Dept., General Electric Company, Schenectady, N. Y.

**GENERAL**  **ELECTRIC**

730-23



# ERIEZ MAGNETIC ATTRACTIONS

ERIEZ MANUFACTURING CO, ERIE, PA., U.S.A. • PRODUCERS OF MAGNETIC SEPARATORS  
AND SELLERS OF  ELECTRONIC METAL DETECTORS



IT'S A FACT...734,254 BEEF LIVERS AND 59,56 CARCASSES WERE  
CONDEMNED IN A YEAR BECAUSE OF ABSCESS AND PERICARDITIS CAUSED  
BY **TRAMP IRON** IN CATTLE FEED. LOSS...OVER 3 MILLION DOLLARS!  
**ERIEZ** ATOMAGNETS FIGHT THIS BECAUSE THEY WON'T LET  
TRAMP IRON PASS.

## TO KEEP THE WALLS UP

THEY USED **ERIEZ**  
PERMANENT PLATE  
MAGNETS IN GRAVITY  
FLOW CHUTES AT AN  
OHIO CHEMICAL PLANT.  
WITHOUT THIS PROTECTION  
FROM TRAMP IRON  
SPARKING, EXPLOSIONS  
WERE SO FREQUENT...  
9 A DAY AVERAGE....

THAT THE WALLS  
WERE MADE TO FALL  
OUTWARD AT THE  
SLIGHTEST BLAST TO  
AVOID MAJOR DAMAGE!

..... SINCE  
INSTALLATION .....  
**NO EXPLOSIONS!**

## YOU DON'T HAVE TO BEAT THIS DRUM

...FOR RESULTS. THE **ERIEZ** MAGNETIC  
DRUM AUTOMATICALLY REMOVES STRAY  
IRON.... SOME DANGEROUS TO MACHINERY....  
SOME THAT CAN BE SOLD. USED IN  
EVERY INDUSTRY!



**FIVE DOLLARS SAVED  
A YEAR FOR EACH  
DOLLAR INVESTED...**

THE RESULT OF  
**ERIEZ** MAGNETIC HUMP  
SEPARATOR INSTALLATIONS  
AT A SOUTHERN TEXTILE  
PLANT. **WOODSIDE MILLS.**  
AVERAGE NUMBER OF FIRES  
BEFORE **ERIEZ** HUMPS  
WERE IN **12** PER YEAR!  
AFTER INSTALLATION....  
NO FIRES...NO PRODUCTION  
DELAYS!



**ERIEZ** MANUFACTURING COMPANY  
1116 EAST 12th STREET, ERIE, PA.

MY CONTAMINATION OR SEPARATION PROBLEM IS:

PLEASE SEND LITERATURE ☐  
HAVE REPRESENTATIVE CALL ☐ PROMPTLY ☐ WHEN IN AREA  
NAME \_\_\_\_\_  
TITLE \_\_\_\_\_  
COMPANY NAME \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

RETURN THIS  
COUPON.

# WHERE you get it... DOES make a difference



When you place your order with Barrett you're assured prompt, dependable service and top quality products, backed by 96 years of successful manufacturing experience.



## WHEN YOU NEED A COAL-TAR CHEMICAL

Phenols  
Cresols  
Cresylic Acids  
Chlorinated Tar Acids  
Xylenols  
Pickling Inhibitors  
Benzol  
Toluol  
Xylol  
Naphthalene  
Hi-Flash Solvent  
Phthalic Anhydride  
Dibutyl Phthalate  
ELASTEX® DCHP Plasticizer  
"ELASTEX" 10-P Plasticizer  
"ELASTEX" 50-B\* Plasticizer  
"ELASTEX" 28-P Plasticizer  
Niacin (Nicotinic Acid)  
Pyridines  
Picolines

Quinoline  
Tar Acid Oils  
Neutral Coal-tar Oils  
Coal-tar Creosote  
CUMAR® Paracoumarone-Indene Resin  
Carbonex® Rubber Compounding Hydrocarbon  
Bardol® Rubber Compounding Oil  
Flotation Agents

GET IT FROM...

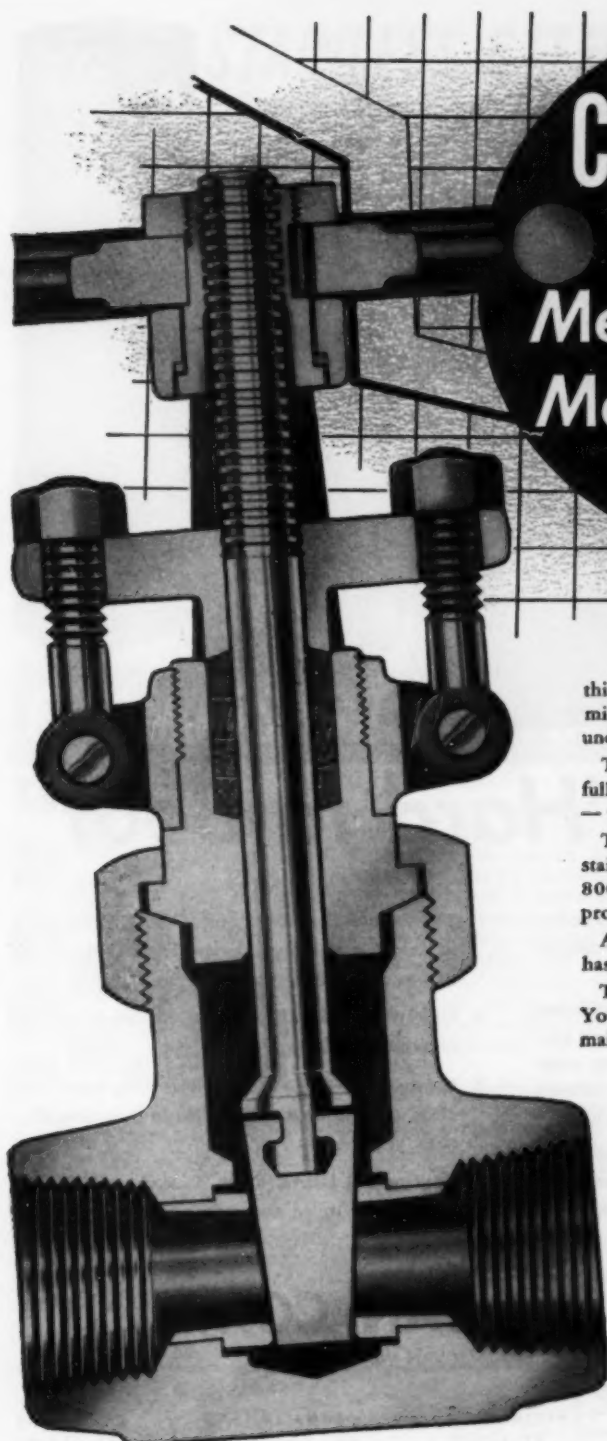


**THE BARRETT DIVISION**

ALLIED CHEMICAL & DYE CORPORATION  
40 Rector Street, New York 6, N. Y.

\*Reg. U. S. Pat. Off.

March 1951—CHEMICAL ENGINEERING



# CHAPMAN

## LIST 960

### Means Lower Maintenance Costs

Chapman engineers designed this valve with your maintenance problem in mind. They've made it *tough*, so it will stand up under severest service — but *easy* to maintain.

That's why you can repack this List 960 under full pressure. Seat rings replaced quickly, easily — when necessary.

The reason, too, why seat rings are hardened stainless steel and wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

And why the stem and wedge gate connection has been made 50% stronger than ever before.

Try it! Make your own maintenance checks. You'll find the Chapman List 960 means lower maintenance costs.

Available in sizes from  $\frac{1}{4}$ " to 2". Either metal to metal or gasketed joint, as required. Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

**The Chapman Valve  
Manufacturing Company**

INDIAN ORCHARD, MASSACHUSETTS



## Drums — "Hard to Beat"

The same Continental fibre drums that serve industry so well are giving an equally good accounting of themselves in military service.

Continental drums give extra protection to dangerous, expensive or hard-to-handle articles for shipment anywhere. Their light tare weight cuts shipping costs. They load compactly and ride safely. The closures are tight and strong, but easy to open and close.

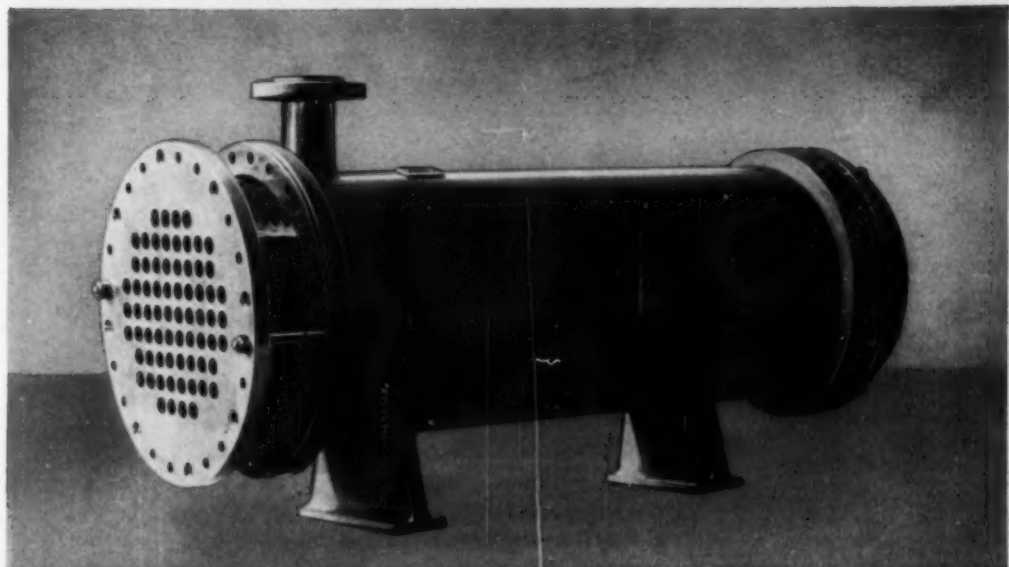
In addition to being rugged and durable, these drums can't be beat for appearance. They are neat and trim and feature quality printing or spray painting.

1. The famous Continental LEVERPAK drum with its unique lever-locking device gives maximum protection under hard usage. 12- to 75-gallon sizes.
2. Continental FIBERPAK drum...a rigid, all-fibre container in ¼- to 67-gallon sizes.
3. Continental STAPAK drum. Has fibre body with metal top and bottom. Supplied in 2- to 35-gallon sizes.
4. Continental UPAK drum. Custom-made for the shipment of rolled materials.

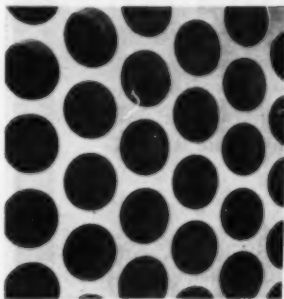
**CONTINENTAL © CAN COMPANY**  
 FIBRE DRUM DIVISION      VAN WERT, OHIO

NEW YORK • PHILADELPHIA • PITTSBURGH • TONAWANDA • CLEVELAND  
 CHICAGO • SAN FRANCISCO • ST. LOUIS • LOS ANGELES • EAU CLAIRE

# *This* STAINLESS STEEL CONDENSER..



## CHANGES GAS INTO LIQUID FORM



*Note serrated tube holes and quality of the finish.*

This condenser was designed and manufactured by the Heat Transfer Division of DOWNTOWN IRON WORKS, INC.

Shell, tubes and ends are of Stainless Steel. Water is pumped through the shell and around the tubes . . . gas passes through the tubes and is thereby condensed to form a liquid.

Many, many units similar to this are made by DOWNTOWN for domestic and foreign service.

We of DOWNTOWN solicit your inquiry for heavy duty shell and tube equipment fabricated of Aluminum, Inconel, Nickel, Phosphor Bronze, Copper, Silicon Bronze and various grades of Carbon Steel. Some of these are welded by Heliarc. DOWNTOWN is experienced in building equipment with Bimetallic, Finned Tube and Impregnated Graphite.

Design and construction meet requirements of A.S.M.E. Code or other agency specified by customer. Equipment of our design is sold on a guaranteed performance basis or we will fabricate to customer's drawings. Modern facilities available for radiographing where required. Write on your letterhead for DOWNTOWN literature on shell and tube heat exchangers.



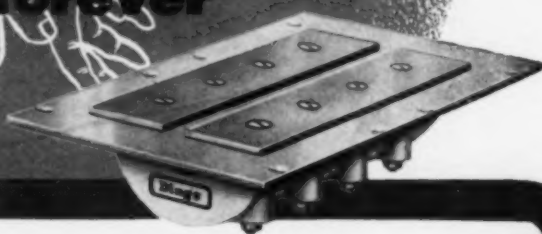
DOWNTOWN IRON WORKS, INC.  
DOWNTOWN, PA.  
STEEL & ALLOY PLATE FABRICATION  
HEAT EXCHANGERS

NEW YORK OFFICE—30 CHURCH STREET



# 1,000,000 FINGERS\*

that will  
work forever



They're specialized fingers that work only on the separation of magnetic substances — they keep iron out of substances in process . . . protect machinery against damage . . . prevent fires and explosions caused by iron sparks . . . they catch iron on the fly and hold it fast!

• • •

ONE MILLION fingers able and willing to do a *real* iron removal job. It's the DINGS PERMA-PLATE MAGNET and its cost is very low. Think . . . how many places can you take advantage of a labor force like this! This force will work for you forever because the Perma-Plate is NON-ELECTRIC, guaranteed PERMANENT.

#### Other Qualifications:

The Perma-Plate Magnet handles solids or liquids, withstands high temperatures, and can be installed anywhere. Its magnetic strength is *certified*. There is a size and strength ideal for any job you have in mind. Get details now.

\*That's the approximate number of lines of force emanating from the surface of a Dings Type II 30" wide Perma-Plate Magnet.

Send for

the Perma-Plate  
Catalog, today.  
IT'S THE MODERN  
WAY TO SEPA-  
RATE IRON.



## DINGS MAGNETIC SEPARATOR CO.

4730 W. Electric Ave., Milwaukee 16, Wis.

*World's Largest Exclusive Builders of Electric  
and Non-Electric Tramp Iron Magnets*

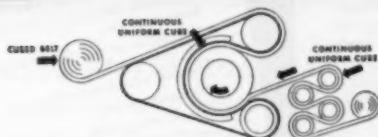




# OCS\*

***It's there even when you don't see it  
...this Achilles Heel of Conventional Belts***

## ROTOCURE eliminates this common cause of Failure



SKETCH OF EXCLUSIVE ROTOCURE PROCESS

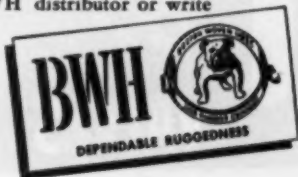
Although they often can't be detected with the naked eye, overcured segments or "Achilles' Heels" are present every 30 to 40 feet in belts cured by the flat press method. They occur because the vulcanization is *not* continuous due to overlapping. These press overlaps of 2" to 4" across the entire width of the belt get a double dose of curing. These segments make for costly operational weaknesses on the job and may result in early and complete failure of the belt.

\* "Overcured Sections"—present every 30' to 40' in all belts made by the flat press method. Only RotoCuring eliminates this basic cause of belt failure.

**BWH ROTOCURED** belts are made differently — the *only* belts constructed by a continuous, endless curing process. Because press overlapping can't happen, overcuring is eliminated and flex life is improved by as much as 40%. Rotocure also eliminates mechanical distortion at the press ends . . . provides constant, uniform stretch . . . assures uniform abrasion resistant covers because one vulcanization and *only one* takes place. The end result is a better belt the first day you put it on . . . a more trouble-free belt day after day — a belt with **MORE** working days built into it! Ask your BWH distributor or write us direct.

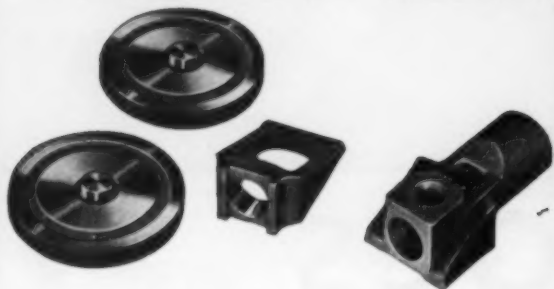
Another Quality Product of  
**BOSTON WOVEN HOSE & RUBBER COMPANY**  
 Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.



*How Darling features prevent trouble and expense*

## Simplified Maintenance



**D**ESIGNED for extreme simplicity, with all parts interchangeable, Darling Fully Revolving Double Disc Parallel Seat Gate Valves assure easy inspection and unsurpassed maintenance economy.

There they are—just four simple gate parts, two plain discs and two wedges . . . readily and quickly removed or replaced as a unit, without disturbing the valve body. Moreover, since the discs are entirely independent and interchangeable, new discs can be installed without laborious bench work or fitting. Likewise, seat rings are made with lugs for easy removal and replacement without removing the valve body from the line.

Extra deep stuffing boxes provide ample packing space. Independent gland bolts permit adjustment or replacement of packing without disturbing the stuffing box bolts.

Finally, all Darling Gate Valve parts are made to established engineering standards, beginning with rigid metallurgical specifications, then controlled all along the way with gauges and templates for complete dimensional accuracy.

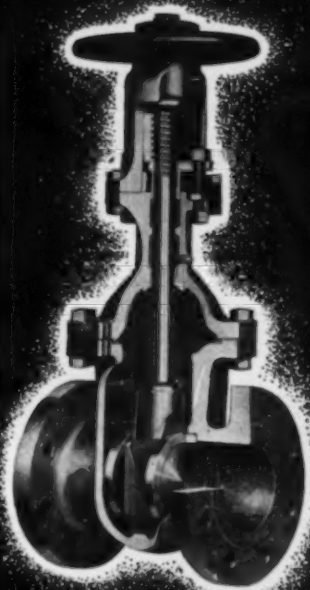
So for low maintenance cost and minimum parts inventory, for long-range economy in every way, specify Darling Fully Revolving Double Disc Parallel Seat Gate Valves.

**DARLING VALVE & MANUFACTURING CO.**  
Williamsport 3, Pa.



*Outline your service requirements and get complete information on Darling Valves of the proper type. Or, send for the complete 300-page Darling Catalog No. 17M. It describes Darling Valves of all types for every normal or unusual service, and for pressures up to 1500 pounds. It's full of helpful information . . . Yours for the asking.*

THE VALVE MARK OF QUALITY . . . WATCH FOR IT



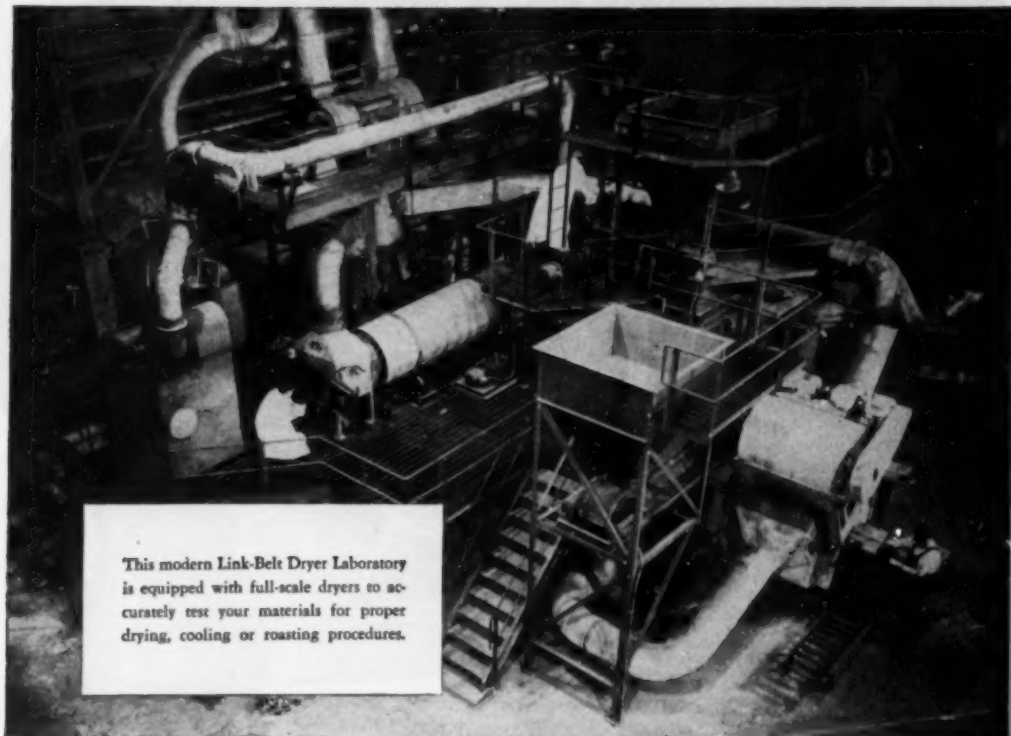
*"This advertisement is one of a series showing how the unique Darling Fully Revolving Double Disc Parallel Seat Gate Valves answer the following critical operating problems:*

- Positive, easy closing—regardless.
- Automatic adjustment for valve body distortion.
- Elimination of disc-to-seat friction and galling.
- Uniform wear distribution.
- Extreme simplicity.
- Greater service life.
- Simplified maintenance.

### CORROSION RESISTANT VALVES

In addition to conventional iron, bronze and steel constructions, Darling specializes in valves for any corrosive fluid: iron body valves with special alloy trim; iron body, rubber lined, with special alloy trim; all bronze; and all special alloy. Darling's 50 years of experience in meeting unusual requirements is always at your service.

# An invitation to manufacturers with Drying, Cooling or Roasting Problems



This modern Link-Belt Dryer Laboratory is equipped with full-scale dryers to accurately test your materials for proper drying, cooling or roasting procedures.

***LINK-BELT will test-run your material and work out procedures in this laboratory that can be duplicated in your plant...***

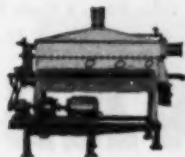
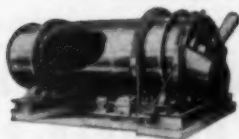
Here's a practical suggestion: Send us a sample of your materials. We'll test them for the one best drying, cooling or roasting procedure. Based on more than 1,000 such tests, in the Link-Belt Dryer Laboratory, nearly 500 Link-Belt Dryers are now operating profitably throughout the world!

We can test a pound or a ton. But if your materials can't be shipped, we'll supply a unit (on a loan basis) for experiments in your own plant. Your nearest Link-Belt office or plant will gladly supply all details.

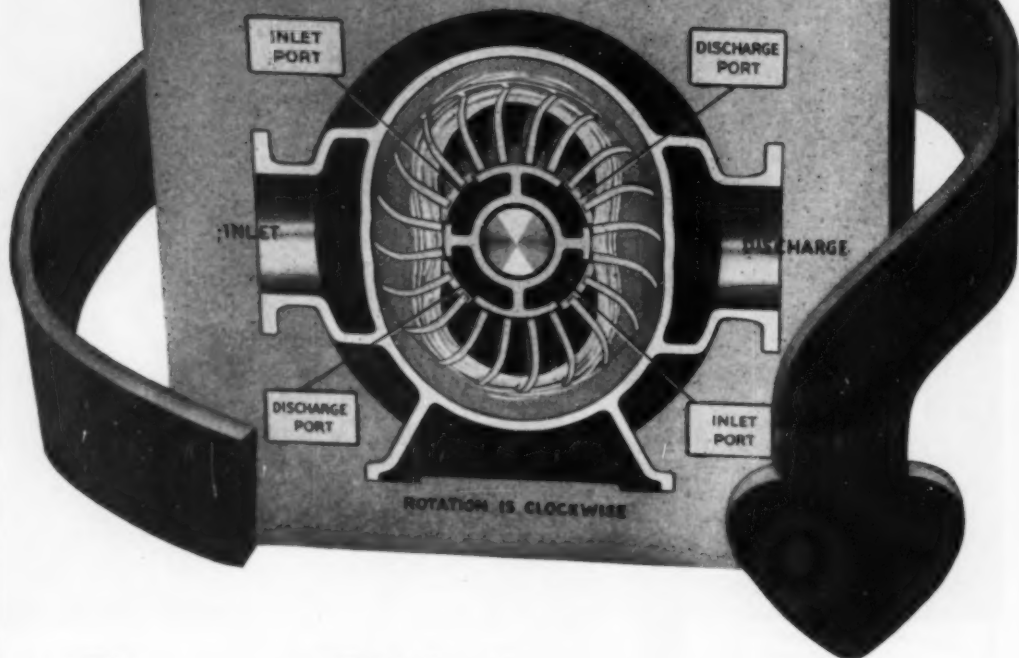
**LINK-BELT COMPANY:** Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in principal cities.

**LINK-BELT**

• DRYERS • COOLERS • ROASTERS



**Nash Instrument Air Compressors  
deliver only clean air, free from  
oil or dust, and without filters**



## *Here is Why!*

You can dispense with oil filters and dust filters when you install **Nash® Clean Air Compressors**. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

**Nash® Clean Air Compressors** are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

**No oil filters.**

**No dust filters.**

**No internal lubrication to  
contaminate air handled.**

**No internal wearing parts.**

**No valves, pistons, or vanes.**

**Non-pulsating pressure.**

**Original performance constant  
over a long pump life.**

**Low maintenance cost.**

**NASH ENGINEERING COMPANY**  
**370 WILSON, SO. NORWALK, CONN.**



# Facts you should know about De Laval turbines!

## This turbine has two traffic cops...

that give you double protection against overspeeding. The normal speed governor and overspeed governor are entirely separate. A sticky governor valve can't possibly jeopardize the operation of the overspeed governor and trip.

## You can elect the governor that meets your requirements!

We have eight candidates for the job, so take your choice:

**Mechanical Shaft** governor with smooth-acting, long-wearing "rocking chair" action.

**Vertical Mechanical** governor geared to shaft for speeds above 4500 rpm.

**Hydraulic Governor.** Direct acting orifice-type for high speeds and/or wide range of speed adjustment.

**Hydraulic Oil Relay** for close regulation or for supplying extra power for valve movement.

**Flyweight Oil Relay** for close regu-

lation such as encountered in synchronous generator drives.

**Pressure Controls** for constant pressure or differential pressure regulation of pumps, blowers, etc.

**Speed Changers,** manual or remote control by electric motor drive.

**Auxiliary Trips** to shut off steam in the event of low pressure in the lubrication system or undue rise of back pressure. Also can be solenoid operated for remote or manual trip, or for inter-connection with the driven machine or any emergency system.



Send for Catalog 82-19R

**DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.**

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS  
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

**50<sup>th</sup>**  
**DE LAVAL**  
*Anniversary*



## STAINLESS STEEL DRUMS

"Made of stainless steel!  
That means long life and  
almost resistance to corrosion—  
very attractive appearance."

"Look inside—no  
chine crevices! There's  
no place for foreign  
matter to lodge."

"Absolutely liquid-tight—  
no chance for  
leakage in or out."

"They're exceptionally  
lightweight—  
easy to handle.  
Yet they're  
strong, too!"

"Head is completely  
removable. Emptying and  
cleaning are easy. Your  
choice of two types of  
closures—the famous  
quick-acting Toggle-lid  
or bolt type."

"And look at the  
specially formed Hackney  
welded chime construction.  
That's what insures a  
smooth bottom... so easy  
to clean and keep clean."

# TO YOU...

## THESE FEATURES MEAN YEARS OF LOW-COST SERVICE!

No wonder shippers say Hackney Stainless Steel Drums can't be excelled for shipping many chemicals and foods! They like them, too, because they're returnable containers—will keep giving their low-cost advantages year after year.

Perhaps your shipping and storage facilities could profit by the use of Hackney Stainless Steel Drums. They are also available in mild steel, plain, galvanized or tinned. Write for full details.

### Another Important Hackney Product

HACKNEY REMOVABLE HEAD  
SEAMLESS ALUMINUM  
BILGED BARRELS

These Hackney aluminum barrels are ideal containers for many types of products—foods, chemicals, etc. They are lightweight, sturdy and economical. Also available in mild steel.

## PRESSED STEEL TANK COMPANY

Manufacturer of Hackney Products

1447 S. 66th St., Milwaukee 14 • 1225 Vanderbilt Cancoors Bldg., New York 17 • 203 Hanna Bldg., Cleveland 15 • 936 W. Peachtree St., N. W., Room 112, Atlanta 3 • 208 S. LaSalle St., Room 792, Chicago 4 • 850 Roosevelt Bldg., Los Angeles 14.

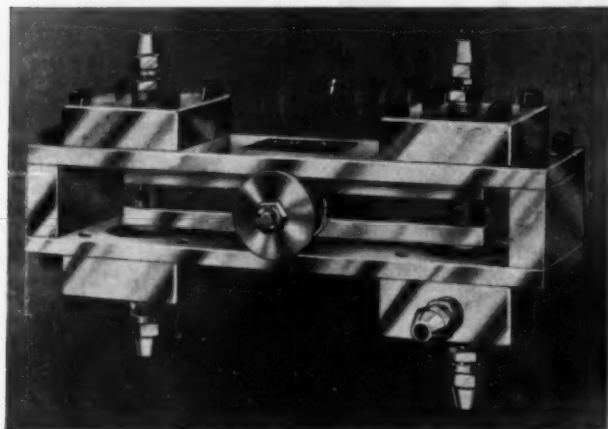
CONTAINERS FOR GASES, LIQUIDS AND SOLIDS



# Hagan Ratio Totalizer

UP TO THREE INPUT SIGNALS COMBINED  
ACCURATELY TO GIVE ONE OUTPUT SIGNAL

Here are a few of the things  
you can do with this versatile  
pneumatically-operated  
automatic control mechanism:



## HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS  
**THRU-STAR** FORCE MEASURING DEVICES  
BOILER COMBUSTION CONTROL SYSTEMS  
METALLURGICAL FURNACE CONTROL SYSTEMS

1

Add, subtract or average pneumatic indications of flow rates, to secure a pneumatic indication of the totalized flow.

2

Transmit an output signal which is in a definite ratio to the measured static pressure.

3

Establish a remote pneumatic set point adjustment, or introduce rate of change or automatic reset characteristics into an automatic control system.

4

Establish a wide variety of selector or limiting control actions, by using Totalizer units singly or in multiple.

For detailed information concerning this extremely versatile mechanism, just fill in and mail the coupon or write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa., giving details of any specific application in which you are interested.

Hagan Corporation  
Hagan Building  
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ratio Totalizer. I am particularly interested in.....

NAME .....

POSITION .....

COMPANY .....

STREET AND NUMBER .....

CITY ..... ZONE ..... STATE .....

CE-3



# Try Republic First...

**THERE'S A SPECIAL REPUBLIC HOSE FOR EVERY NEED**

Chances are your "special" hose problems have long since been solved by Republic Rubber.

Republic makes hundreds of different kinds of hose, each tops in its own right, each originally developed for "special" requirements of industry.

Your local Republic Distributor knows the entire Republic line... knows which specific product fits your need best. Give him a call today or write us direct. If the hose you need isn't already made, it soon will be—by the specialist in the field of industrial rubber.



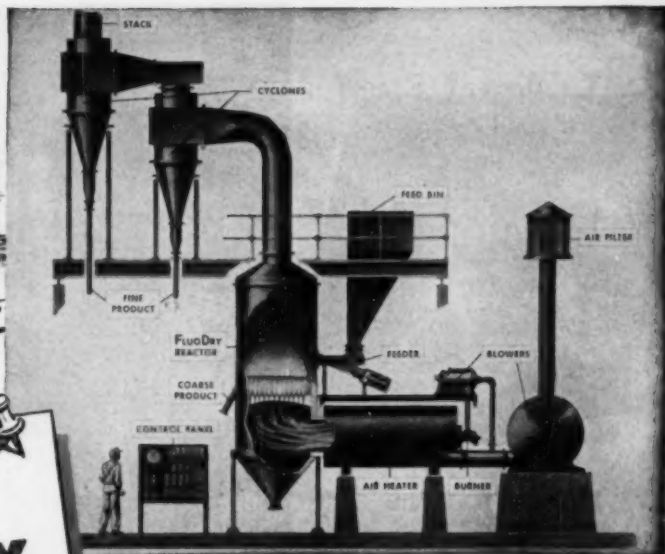
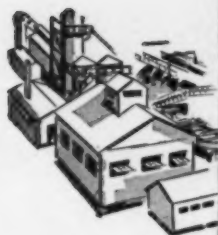
**INDUSTRIAL RUBBER PRODUCTS BY  
REPUBLIC RUBBER DIVISION**

Lee Rubber & Tire Corporation  
YOUNGSTOWN, OHIO



"Republic's New Hot Water Wash-down Hose has a tough grime-resistant cover that doesn't mark or discolor our stainless steel marking equipment. What's more the hose is lightweight, flexible, easy to handle in every respect. We've sold on Republic!"





## *the Dorco* **FLUODRY** *system*

A new method of drying surface moisture and of accurately dry-sizing in the 28 to 100 mesh range through the use of fluidization.

### Limestone and Dolomite Fines

FluoDry can dry limestone or dolomite fines as produced, or as reclaimed from stockpile, and recover them as such salable products as limestone sands, agstone or higher-priced fillers.

### Sand Products

FluoDry can dry, or selectively size, sand products in those ranges where the material is too fine to screen and too coarse for air separation.

### Industrial Minerals

FluoDry can dry industrial minerals such as phosphate rock, potash and ilmenite sands with greater efficiency and economy than conventional methods.

If these facts sound interesting and you have an active problem of drying or sizing, we will be glad to discuss it in detail.

#### WHAT ARE THE ADVANTAGES OF FLUODRY AS COMPARED WITH CONVENTIONAL DRYING AND SIZING METHODS?

1. More accurate temperature control
2. Lower fuel requirements
3. Lower maintenance costs
4. Lower investment cost
5. Lower operating cost
6. No moving parts



#### THE DORR COMPANY, ENGINEERS

BAKERY PLACE, STAMFORD, CONN.

NEW YORK • ATLANTA • TORONTO

CHICAGO • DENVER • LOS ANGELES

RESEARCH AND TESTING LABORATORIES

WESTPORT, CONN.

#### SUGAR PROCESSING

PETREE & DORR DIVISION, STAMFORD, CONN.

#### ASSOCIATES AND REPRESENTATIVES

Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

# DORR

RESEARCH — ENGINEERING — EQUIPMENT





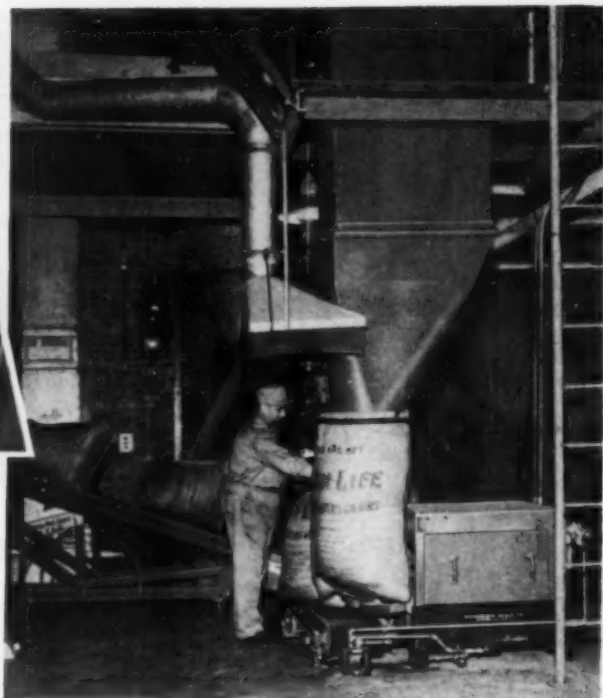
**RICHARDSON'S  
SPEED TEAM  
STEPS UP PRODUCTION  
FOR  
MILLER  
BREWING  
COMPANY**

**PROBLEM:**

To provide a system for the automatic bagging of bulky spent brewer's grains. System to discharge and pack exact pre-set weight into bags, and convey bags to machine for sewing. Entire operation to be handled by one man.

**SOLUTION:**

Installation of a Richardson Automatic Bagging Scale teamed with a Richardson Oscillating Packer. 100 lbs. of grain discharged and packed into bags measuring 31½" wide by 45" long. Rate increased to 3 completed bags per man minute.



Miller Brewing Company, brewers of the famous **HIGHER LIFE** beer was faced with a problem familiar to many industries today: a by-product which could be more profitable if weighed and bagged economically and at a high rate of speed. Richardson solved this problem just as it has done for so many other companies concerned with materials handling by weight.

With today's shortage of materials and time, coupled with increasing production demands, it is essential for the ingredients used in manufacturing to be proportioned, conveyed and blended accurately and rapidly. Richardson automatic feeding, weighing, proportioning and conveying systems lend themselves to the handling of nearly every type of material. Lumpy or even sluggish materials are easily managed. No matter what your problem in materials handling by weight, consult a Richardson engineer for the economical, efficient solution.

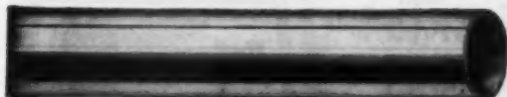
Bulletin 0450 lists 198 materials keyed to Richardson equipment. Bulletin 0550 describes Richardson proportioning, blending and process control equipment. Write today for your copies.

**Richardson Scale Co., Clifton, New Jersey.** Feeder-Weigher Systems of All Types: Automatic Bulk Weighing Hopper Scales, Including Conveyor-Feed Types—Continuous Feeder-Weighers—Automatic Bagging Scales—Bag-Sewing Conveyors—Packers—Process Control Panels. Branch offices in: Atlanta • Boston • Detroit • Minneapolis • Cincinnati • Wichita • Montreal • Omaha • New York • Pittsburgh • San Francisco • Toronto • Buffalo • Chicago • Philadelphia • and Houston.

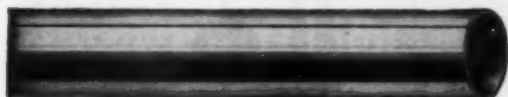
# Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

## RESISTANCE TO CORROSION



## STRENGTH AT HIGH TEMPERATURES



## RESISTANCE TO OXIDATION



## EASE OF FABRICATION



**TYPICAL ANALYSES:** 301 - 302 - 302B - 304 - 308 - 309 - 309S - 309Cb - 310 - 314 - 316  
316Cb - 317 - 321 - 329 - 330 - 347 - 403 - 405 - 410 - 416 - 430 - 443 - 446 Inconel\* Nichrome\*\*

\*Registered U. S. Trade-Mark. \*\*Trade-Mark Reg. U. S. Pat. Off.-D-H Co.



## SEAMLESS OR WELDED



Globe produces 26 standard analyses of stainless steel tubes — also special analyses when required.

Globe seamless stainless steel tubing may be had in sizes from 1/2 inch to 6 3/4 inches O.D., and in pipe sizes 1/4 inch to 6 inches, standard, extra strong and double extra strong weights.

Gloweld electric welded stainless steel tubing may be had in sizes ranging from 1/4 inch to 5 inches O.D. inclusive; in standard weight pipe (schedule 40) sizes 1/4 inch to 2 inches — in light weld pipe (schedule 40) sizes 1/4 inch to 4 1/2 inches inclusive.

Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

**GLOBE STEEL TUBES CO., Milwaukee 4, Wis.**  
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia  
St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

**What's Your Job For  
Stainless Steel Tubing? . . .**

**Do The Job Best With The  
Best Tubing For The Job — Get**

# GLOBE

**STAINLESS STEEL TUBES**  
Seamless or Welded



**GLOBE SEAMLESS  
STAINLESS STEEL TUBES**

**GLOWELD WELDED  
STAINLESS STEEL TUBES**

Write for Bulletin 501 — Corrosion and Heat Resisting Steel Analyses Chart—a valuable reference tabulation of stainless steel analyses as produced by various manufacturers.



# **valvEvents**

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



## **Minimum Pressure Drop SAVES POWER**

The beveled vane of an R-S Valve seats firmly against the valve body to produce commercially tight shut-off with metal-to-metal seat. A rubber seat produces drip-tight closure. In the open position the streamlined vane creates a Venturi action. Pressure drop in R-S Valves is low, and they therefore produce substantial savings in pumping costs.

Illustration shows a heavy duty R-S Valve used in the water system to a compressor house. Valve is equipped with diaphragm motor, handwheel control with self-locking worm and gear and declutching mechanism together with outboard bearing for operating shaft with goose neck support.

Every R-S Valve is engineered and constructed for rugged service and provided with such safety factors that it will give complete satisfaction in the service for which it is designed. Consult with your local R-S Valve Engineers or write direct.

**R-S PRODUCTS CORPORATION**  
**4600 Germantown Avenue**  
**Philadelphia 44, Pa.**

AN S. MORGAN SMITH COMPANY SUBSIDIARY



No. 579—6-inch  
15-pound Direct  
Action Float  
Valve with  
counter-weight  
assembly.



No. 628—Solenoid Trip Valve is  
used for emergency service. The  
solenoid can be arranged with the  
counter-weight mechanism to open  
or close the valve and hold it there  
in one position or the other. If for  
any reason the solenoid functions,  
the latch is tripped, which permits  
the counter-weight to open or close  
the valve by gravity. The assembly  
is suited to shut off the flow or to  
open a vent and requires manual  
reset. Can be constructed of any  
metal or alloy and in various sizes  
for air, gases, steam, oil, hydraulic  
and other services.



No. 677—1500-pound Welding End  
Steel Valve for superheated steam  
service. A.S.M.E. standards with heavy  
duty handwheel control.



No. 795—Three-inch 3-way Valve Type  
No. 733 utilizing standard tee and two  
wafer valves with extended handwheel  
control.

# New *Carpenter* Slide Chart contains useful data on STAINLESS TUBING and PIPE



To help you conserve Stainless and get best results from the tubing and pipe you use, Carpenter has prepared this handy slide chart. It contains data on economical tube bending radii and coil diameters for light-walled Schedule 5 pipe.

This Carpenter Slide Chart gives you—

Bending radii for Stainless Tubing  
(with and without mandrels)

Coil diameters for Stainless Pipe  
(Schedules 5, 10 and 40)

Technical data on

Tensile Strength  
Rockwell Hardness  
Heat Resistance  
Thermal Conductivity, etc.

## How to Get Your Copy of the New Carpenter Stainless Tubing Slide Chart

Just drop us a note on your company letterhead, and we will be glad to send you a copy of this useful slide chart. You can use it to conserve critical material by getting best possible results where you use Stainless Tubing or Pipe.

**THE CARPENTER STEEL COMPANY**

Alloy Tube Division, Union, N. J.

Export Department, Reading, Pa. "CARSTEELCO"

# Carpenter

## STAINLESS TUBING



— guaranteed on every shipment

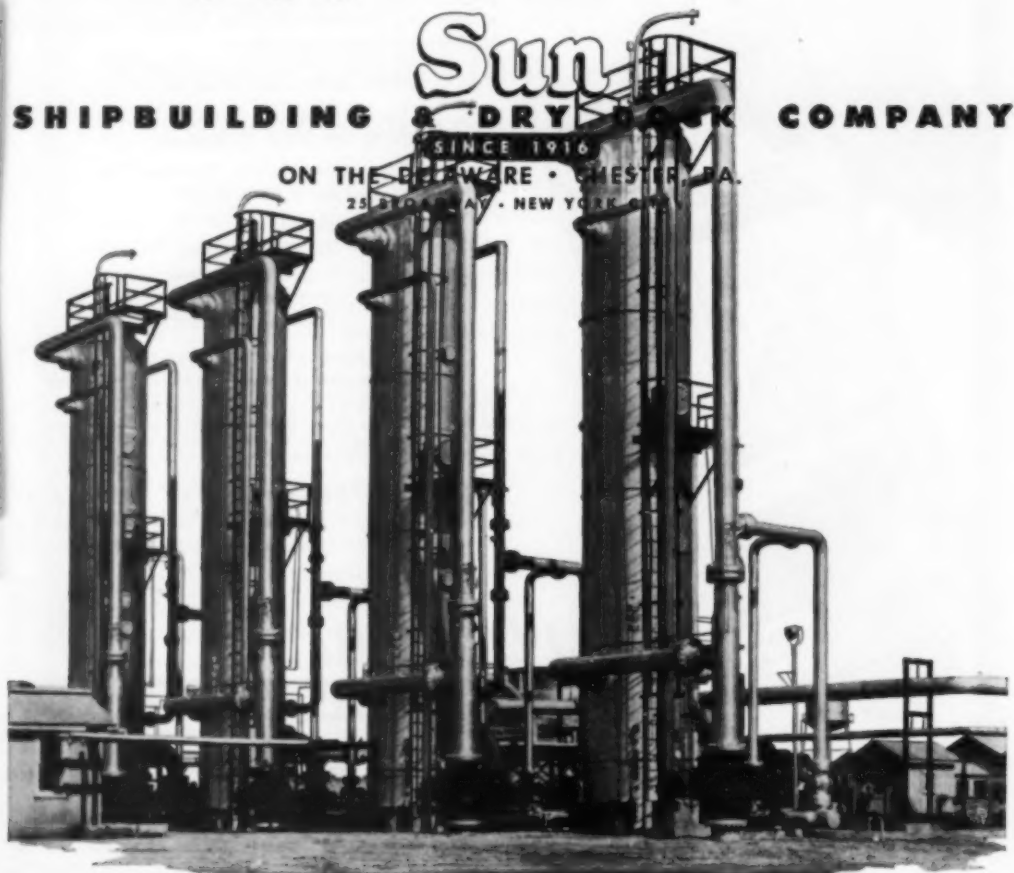
# Built FOR better LIVING

That is what the carefully patterned mazes of refinery equipment, produced by Sun for many leading refineries, mean for America.

These towering refineries mean light, heat, comfort and power for the nation's homes and industries . . . fuel for transportation by ship, rail and motor car . . . mobility for our naval and military forces.

They must not fail . . . *they will not fail!* Into their making have gone Sun's engineering skill and craftsmanship, time-tested in wide fields of mechanical production . . . in refinery and chemical plant equipment, in shipbuilding, in fabricated steel work, in the renowned and powerful Sun-Doxford marine Diesel engines and other specialized machinery.

The more exacting the specification, the greater opportunity for Sun to maintain its engineering prestige.





**now available**

★ SEATTLE  
★ BELMONT  
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★ CHICAGO  
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★ HATTBORO

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**Authorized Distributors of  
PYREX Brand  
"DOUBLE-TOUGH" PIPE  
for the  
Processing Industries**

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Southern Glass Company  
Box 58  
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904-910 St. James Street West  
Montreal 3, Quebec, Canada  
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Stemmerich Supply Company  
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State Highway 51a  
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## NATION-WIDE STOCK PILES OF PYREX BRAND "DOUBLE-TOUGH" GLASS PIPE!

**FASTER SERVICE**—To readily solve your pipeline transfer of corrosive liquids and gases in the plant, Corning announces the appointment of 11 strategically located stock carrying engineer-distributors. They carry full stocks of all popular sizes of Pyrex Brand "Double-Tough" Pipe and Fittings. These distributors can help you layout, cut and install Pyrex Pipe. If on the spot delivery has held up your consideration of Pyrex Pipe Lines these distributors will answer your problem. No long delays . . . no plant tie-ups!

**POSITIVE PROTECTION**—Whether you are handling a product extremely sensitive to contamination or highly corrosive, Pyrex Pipe is your lowest cost material. *And it's available!*

**EXTRA STRENGTH**—Pyrex Brand "Double-Tough" Pipe is made from machine drawn heavy wall tubing. A new heat treating process doubles the strength of the ends of straight lengths and all standard fittings (except U-bends). High resistance to physical and thermal shock makes it practical plant material. Let it solve your piping problem now.



**CORNING GLASS WORKS**  
CORNING, NEW YORK

*Corning means research in Glass*

1951 • 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL • 1951

Technical Products Division: Laboratory Glassware, Signalware, Glass Pipe, Gauge Glasses, Lightingware, Optical Glass, Glass Components

**CORNING GLASS WORKS, Dept. CE-3, Corning, N. Y.**  
Please send me your new Pyrex Brand "DOUBLE-TOUGH" Glass Pipe Catalog.

NAME \_\_\_\_\_  
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CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



## Heat Exchanger Construction Improved with Unique Equipment

**Heat exchangers** frequently require special design and construction features for their specific process applications.

**A. O. Smith** can draw on a 77-year background of experience and some 300 engineers and technicians to solve these special problems.

**Here you see** an application of electric resistance heating of tube areas to be bent. The immediate advantage is closely controlled zone heating which can be done faster, more uniformly, and

with less scaling of the tube, than with some other methods of heating.

**Let A. O. Smith** design and build your heat exchanger. Take advantage of our extensive experience in thermal design, engineering, metallurgy, welding and fabricating.

**Facilities** as well as the skill to satisfy your most exacting requirements are here . . . feel free to call on A. O. Smith when confronted with a heat exchanger problem.



**A.O. Smith**  
HEAT EXCHANGERS

Atlanta 3 • Boston 16 • Chicago 4 • Cleveland 15 • Dallas 2  
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Phoenix 2 • Pittsburgh 19 • Salt Lake City 1 • San Diego 1  
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International Division: Milwaukee 1

# **GRAVER**

**can eliminate  
all these  
impurities  
from water...**

Are any of these impurities causing plant shut-downs . . . equipment failures . . . high production costs?

Graver can eliminate any or all of these impurities from your water supply . . .

. . . because Graver manufactures every type of water treating equipment . . . hot and cold process softeners . . . cold and hot zeolite softeners . . . demineralizers . . . deaerating heaters . . . filters . . . chemical feeders . . . combination systems.

. . . because Graver brings complete research, laboratory, pilot plant, process development, equipment designing, manufacturing and erection facilities to bear on the solution of individual water-treatment problems.

. . . because Graver has a 40-year record of pioneering in the advance of water-treatment processes and the development and improvement of water-treating equipment.

. . . because Graver has many thousands of successful installations to prove the correctness of Graver recommendations and the effectiveness of Graver processes and equipment.

Graver provides authoritative advice on the most modern proven methods and designs for solving your particular water treating problem. Send sample of your raw water supply for free analysis and recommendations without obligation.



## **GRAVER WATER CONDITIONING CO.**

Division of Graver Tank & Mfg. Co., Inc.  
216 WEST 14TH STREET, NEW YORK 11, N. Y.  
Chicago • Philadelphia • Cleveland

$Mg^{++}$   
 $Ca^{++}$   
 $Na^{+}$   
 $Fe^{++}$   
 $Fe^{+++}$   
 $Mn^{++}$   
 $SO_4^{--}$   
 $CO_3^{--}$   
 $HCO_3^{-}$   
 $Cl^{-}$   
 $SiO_2$   
 $CO_2$   
 $O_2$   
Turbidity  
Color  
Organic  
Matter

# 25

## GOOD REASONS

### WHY INDUSTRY DEPENDS ON SPERRY FOR FILTRATION

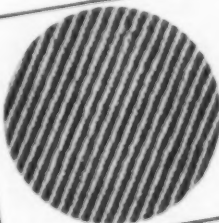
The plate filter press, the filtration method pioneered by Sperry is the most widely used filter in industry today. The inherent advantages of this type of filter explain its wide usage.

Consider these advantages as applied to your own operation. Compare the flexibility, low first cost, low operating cost of a Sperry Filter Press with any other type of filter on the market.

For more specific data as to your own filtration problem consult Sperry. Send samples of your material for a test run.

#### SPERRY FILTER BASES

Sperry offers a full range of filter bases. All types and sizes. Plain or punched to your specifications. In addition to cotton and paper, bases are furnished in wool, synthetics, glass and woven metals. Consult Sperry for special bases to meet unusual requirements.



#### D. R. SPERRY & COMPANY

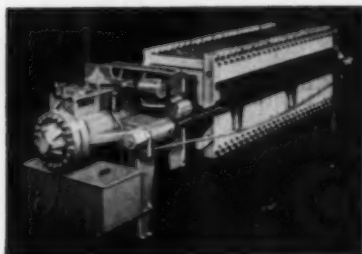
BATAVIA, ILLINOIS

Filtration Engineers for over 30 years

Eastern Sales Representative: H. E. Jacoby, M. E.  
205 E. 42nd St., New York 17, N. Y.; Phone MUrray Hill 4-3581

Western Sales Representative: B. M. Pilchay  
833 Merchants Exchange Bldg., San Francisco 4, Calif.  
Phone DO 2-0375

## SPERRY FILTER PRESSES



#### THE SPERRY FILTER PRESS:

1. Will handle any kind of filterable mixture, including viscous substances.
2. Produces maximum clarity.
3. Produces the driest cake.
4. Can deliver cake in slab form suitable to place in drier trays.
5. Thoroughly washes the cake.
6. Uses the simplest kind of filter cloths. (Can use cloth cut direct from roll.)
7. Cloths are easily removed and replaced.
8. Can use filter paper or pulp.
9. Can be used with precise temperature control.
10. Can handle hot liquors without vaporizing.
11. Is easily made of acid or alkali resistant material.
12. Low first cost.
13. Low cost of labor.
14. Least floor space and head room required.
15. Weight per square foot no greater than other types.
16. Low depreciation.
17. Can perform low, medium, or high pressure filtration.
18. Easily resold. (On account of its wide use.)
19. Can filter without exposing the liquid to the atmosphere.
20. Can be used to separate emulsions.
21. Easily erected by unskilled labor.
22. Can be transported in small pieces.
23. Will deliver filtrate to higher level than filter.
24. Can use wire, wool, asbestos, glass, vinylon, and many other kinds of filter cloths.
25. Can be furnished in leak-proof construction.



**RUGGED**

## **FLEXIBILITY FOR EVERY INDUSTRIAL USE**

### **PENFLEX FLEXIBLE METALLIC TUBING**

is made to meet every requirement of the chemical industry. From  $\frac{1}{4}$ " I.D. to 30" I.D. . . . bronze, galvanized steel, stainless steel or copper . . . from an air compressor line to a diesel exhaust, Penflex makes them all for the chemical industry.

Coast to coast . . . border to border, Penflex installations prove the value of "Flexineering"—the science of applying flexible tubing to fit the

particular need of the chemical industry. When you require tubing or hose that is as tight as a pipe but flexible, safe at high temperatures . . . free from metal fatigue . . . specify Penflex.

Penflex manufactures a complete line of four wall interlocked and seamless welded corrugated flexible tubing . . . plus automatic barrel fillers, rivet passers, accessories and fittings. Write for the folder that will help your production—"Flexineering."

Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Philadelphia 42, Pa.  
Branch Sales Offices: Boston • New York • Chicago • Houston • Cleveland • Los Angeles

# **PENFLEX**

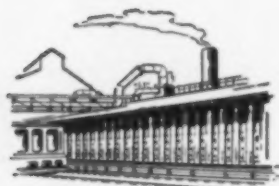
**HEART OF INDUSTRY'S LIFE LINES**

Copyright 1951 Penna. Flexible Metallic Tubing Co., Inc.

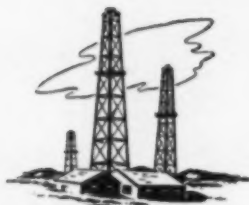


# Make $H_2SO_4$ from $H_2S$

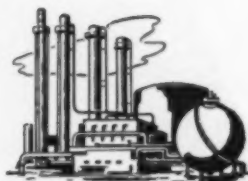
## WITH A CHEMICO PLANT



$H_2S$  DERIVED FROM  
COKE OVEN GAS



$H_2S$  DERIVED FROM  
NATURAL GAS



$H_2S$  DERIVED FROM  
REFINERY GAS

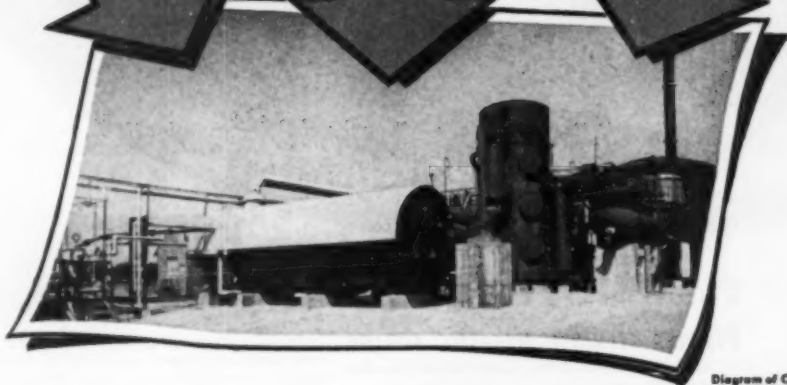
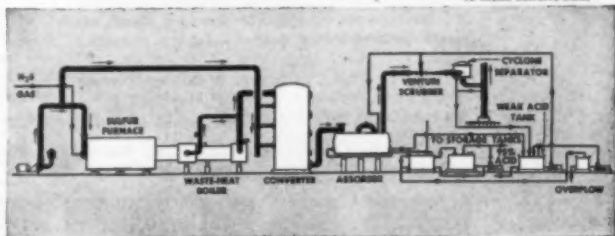


Diagram of Chemico process which utilizes hydrogen sulfide to make sulfuric acid.

Now that raw sulfur is in short supply, it has become necessary to manufacture sulfuric acid from other raw materials such as hydrogen sulfide. If you have hydrogen sulfide available, it will pay you to investigate Chemico's practical and proven process for making  $H_2SO_4$  from  $H_2S$ . Chemico's new type sulfuric acid plant is especially well suited for this purpose. Or existing sulfuric acid plants can be converted.



### CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE: CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND  
CABLES: CHEMICONST, NEW YORK



*Chemico plants are  
profitable investments*

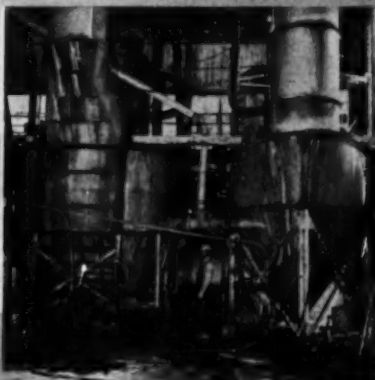
## **GAS-FIRED SUBMERGED COMBUSTION EVAPORATOR**

is production key to  
**Ozark-Mahoning Company's**  
**Glauber's Salt Plant**



Monahans, Texas, plant of Ozark-Mahoning Company, where Glauber's Salt is produced by the Submerged Combustion Method. Vapor clouds are combustion products of this process.

Two Submerged Combustion Evaporator units in the Monahans plant.

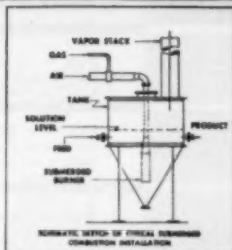


HEAT PROCESSING of Glauber's Salt requires plenty of heat, applied in a variety of ways. To combat former processing difficulties, the Monahans, Texas, plant of Ozark-Mahoning Co., Tulsa, Oklahoma, applies the "Submerged Combustion" principle—burning a Gas flame under water or liquid.

Cooper-Bessemer Gas-burning engines, totaling over 1500 HP, operate process refrigerators which chill natural brine. This brine is filtered, forming a hydrated cake (about 40%  $\text{Na}_2\text{SO}_4$ ). The cake is melted and subjected to Submerged Combustion, forming a concentrated slurry which is pumped into settling tanks. Thick bottom slurry is sent to a classifier. Here dilute slurry returns to evaporators, while thickest slurry is completely dehydrated in a GAS-fired rotary kiln.

Air and Gas are burned in the Submerged Combustion chamber, under sufficient pressure to hold out the solution. Burner volume is about 2 cu. ft., in which some 139,000 Btu/min can be released. This heat evaporates large volumes of water which go into the atmosphere as steam.

Gas-fired Submerged Combustion units are extremely versatile. Largest installation to date releases 120,000,000 Btu/hr, can evaporate 1,000 tons of water daily. Products suitable for this GAS-controlled process include: heating and/or evaporation of solutions of sodium sulfate, potassium chloride, phosphoric acid, zinc chloride, waste citrus peel liquors, production of  $\text{CO}_2$  and inert gases, etc.



Here is a Gas-fired business, utilizing the productive flames of GAS from beginning to end. GAS is always ready to serve you in unusual processes like Ozark-Mahoning's, because of its ready adaptability, accuracy of control, and efficiency. Your Gas Company Representative has the facts, and you'll get the answers if you call him today.



**AMERICAN GAS ASSOCIATION**

420 Lexington Avenue, New York 17, New York

# COMPARISON PROVES the VALUE of VEELOS the Adjustable V-Belt...

If you use v-belts you'll be interested in this clear statement of facts about VEELOS, the link v-belt, and endless v-belts.



These 4 reels of Veeelos provide up to 316 standard v-belt sizes.

COMPARISON TABLE  
VEELOS and ENDLESS V-BELTS

	Veelos V-Belts	Endless V-Belts
<b>ADJUSTABILITY</b>	Any length can be provided for any v-belt drive due to link construction.	Standard or special lengths must be supplied for individual drives.
<b>INVENTORY</b>	MINIMUM INVENTORY. 4 reels can care for every v-belt need in the O, A, B and C widths. No deterioration or obsolescence of spare belts.	LARGE INVENTORY. 316 sizes are required to provide a complete stock in the O, A, B and C widths. Spare belts not immediately used will age and deteriorate.
<b>SPACE</b>	SMALL SPACE. It takes less than 2 square feet of wall or floor space to store 4 reels of easily identified Veeelos.	LARGE SPACE. Walls and ceilings are often covered with stocks of endless v-belts. Identifying and maintaining full stocks is difficult and costly.
<b>INSTALLATION</b>	Installs quickly on any drive without resetting motor or tearing down outboard bearings.	Necessary to reset motor and tear down drives with outboard bearings.
<b>MAINTENANCE</b>	Belts can be adjusted or replaced without moving the motor.	Sliding or pivoted motor bases are necessary to replace endless v-belts. Belts cannot be adjusted individually.
<b>EFFICIENCY</b>	Full power delivery can be maintained because the tension of each belt in a matched set is kept uniform by removing or adding links.	Individual belts cannot be adjusted to maintain uniform tension and provide full power delivery.
<b>LIMITATIONS</b>	No limitations are imposed by belt length.	Limited by the availability of standard or special belt lengths.

If you would like to learn more about Veeelos—how it can save you money and keep your machines producing—write today for your copy of the Veeelos Data Book. It's free and full of facts!



MANHEIM MANUFACTURING & BELTING COMPANY  
MANHEIM, PENNSYLVANIA

... ADJUSTABLE TO ANY LENGTH ... ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof and static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.





## *Fasten it with* **STAINLESS STEEL** *for Better Looks - Longer Life*

### **LEADING PRODUCERS OF FASTENERS USE ALLEGHENY METAL**

A complete line of stainless steel fasteners—all types and sizes of bolts and nuts, rivets, wood and machine screws, cotter pins, washers, etc.—are made of Allegheny Metal by the leading manufacturers in this field. Get in touch with them for catalogs and prices, or write us direct.

**ADDRESS: DEPT. C-15**

Allegheny Metal fasteners are non-rusting, non-staining. They will last as long as, or longer than, the materials they join. You can count on them to stand up through the years—both in strength and in bright good looks.

Best of all, stainless steel fasteners can be used anywhere. It isn't necessary that the materials to be joined are stainless—these corrosion-proof fasteners are the perfect answer for joining other metals, woods, or plastics. And Allegheny Metal fasteners are available in complete variety—you can obtain exactly what your job requires.

For improving quality and reliability wherever they're used—and for the economy of lifetime service—specify fasteners made of the time-tested stainless steel, *Allegheny Metal*.

**ALLEGHENY  
LUDLUM**  
STEEL CORPORATION  
Pittsburgh, Pa.

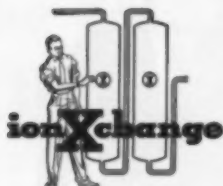
*Nation's Leading Producer  
of Stainless Steels  
in All Forms*



ALLEGHENY METAL is stocked by all  
Joseph T. Ryerson & Son, Inc. warehouses

# Pure Water FOR PHARMA-CRAFT

... from ILLCO-WAY Mixed-Bed De-ionizer

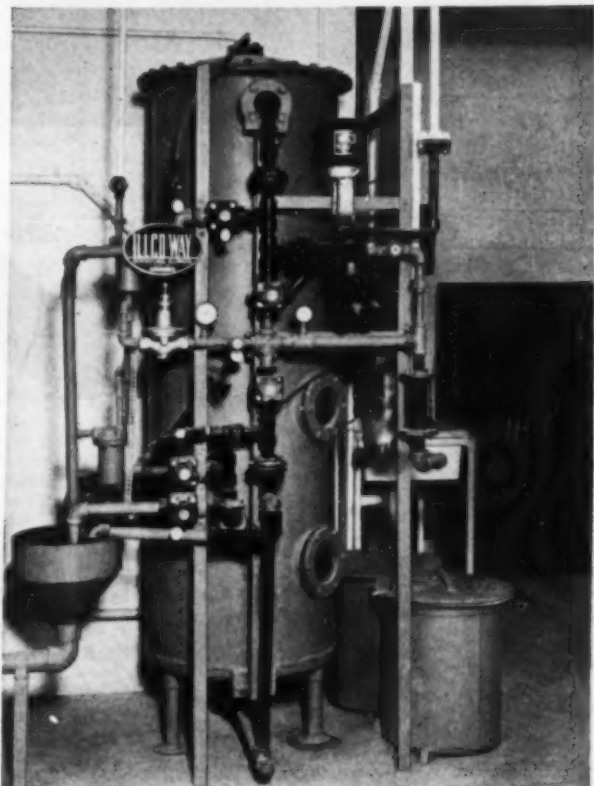


● To obtain the high-purity water required in the manufacture of its well known line of deodorants, Pharma-Craft Corp., Batavia, Illinois, installed the ILLCO-WAY Mixed-Bed De-ionizer shown at right.

Raw water available to Pharma-Craft is 19 grains hardness, with 7 ppm of silica. The ILLCO-WAY de-ionizing unit provides a constant treated water (1500 gph) with total dissolved solids of less than 0.01 ppm and with resistance of over 10,000,000 ohms per cm (18°C) at 56°F.

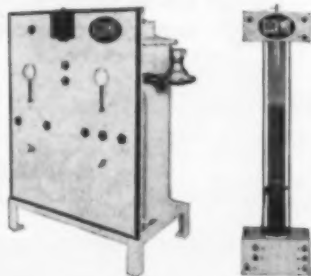
Water of this purity is obtained from practically any water supply with a single pass. *Instant purities* are available during intermittent operation.

Mixed-Bed De-ionizers can be operated on raw water supplies—or added as a final treatment to your present conditioning equipment. Package units (see below) up to 1,000 gph. Larger equipment engineered for specific need. Write for full descriptive literature.



ILLCO-WAY Mixed-Bed De-ionizer (1500 gph) at Pharma-Craft Corp., Batavia, Illinois

**"Packaged" De-ionizers for plants & labs. requiring up to 1,000 gph of chemically pure water**



Same high quality of water is produced by these popular LU series De-ionizers (shown at left) as by the larger ILLCO-WAY industrial installations. Equipment is shipped assembled, requires a minimum amount of work to install. Connection is to existing water and drain lines... new ILLCO-WAY by-pass system assures highest quality water throughout complete service cycle. Because the most efficient type of exchange materials are employed, operation costs only a few cents per thousand gallons of water treated. Write for chart and data.

**ILLCO-WAY**

DE-IONIZING  
DE-ALKALIZING  
SOFTENING

ILLINOIS WATER TREATMENT CO., 844 - 3 Cedar St., Rockford, Illinois • 7310-83 Empire State Bldg., New York



# What's U.S. Rubber doing for electrical design?



The horizons of electrical design are being widened by U.S. Rubber's new thermosetting plastic, Enrup. The transformer handle shown here has greater strength and electrical properties because it is made of Enrup.

This remarkably versatile substance can be punched, sanded, sawed, nailed, bolted, molded or machined. Enrup can be made into almost any shape or form, simple or complex. It may be exactly what you have been looking for to make your product stronger, more efficient, less expensive.

Enrup is fabricated and molded entirely by U.S. Rubber engineers. They will gladly discuss your particular problems. Write to address below.

PRODUCT OF

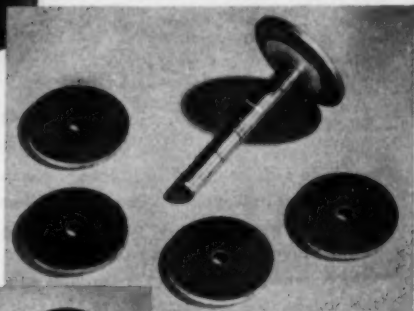


UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

CHEMICAL ENGINEERING—March 1951

Transformer handle made of Enrup for a large manufacturer of electrical equipment. Enrup was selected because its electrical properties can be maintained under very adverse conditions, and because it has great toughness, impact strength, and resistance to other solvents. Enrup has been so successful that the manufacturer intends to use it for other phases of transformer design and construction.



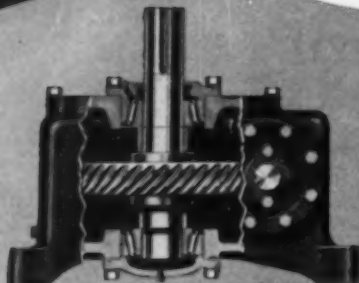
Pump valve seat made of Enrup because Enrup resists swelling or deterioration caused by gasoline, and because it resists compression set or deformation over a wide range of temperature conditions.



This printing roll-end bearing demonstrates Enrup's high adaptability to precision molding techniques. It has high dimensional stability and resistance to corrosion caused by photographic solutions.

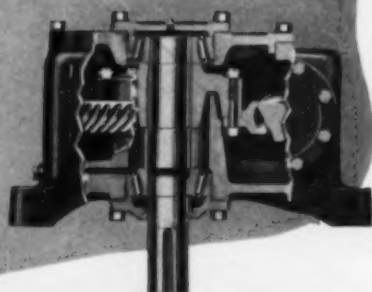
**For Agitators, Mixers,  
And Other Vertical  
Drive Requirements**

**EITHER**



**UP**

**OR DOWN**



**PHILADELPHIA WORM GEAR REDUCERS**

There's a wide range of applications for these speed reducers where the drive is required vertically. Philadelphia Vertical Worm Gear units may be had with the output shaft extended either up or down. The down driven type is made with a unique dry well construction that makes oil leaks down the vertical shaft impossible. Bearings have a generous spread so these units are readily adapted for heavy side loads. They can be supplied in from 7½ to 60:1 and .081 to 262.89 horsepower. The conventional horizontal right angle type also available in the same range of ratios and horsepowers.

Complete details about vertical and horizontal Worm Gear Reducers are in Catalog No. 26. Write for a copy on your Business Letterhead, please.



**Philadelphia Gear Works, Inc.**



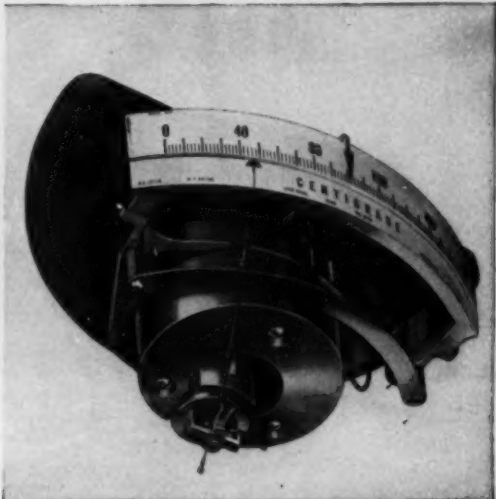
**ERIE AVE. AND G ST., PHILADELPHIA 34, PA.**  
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON  
IN CANADA: WILLIAM AND J. G. GREY LIMITED, TORONTO

*Industrial Gears and Speed Reducers  
LimiTorque Valve Controls*

# ACCURATE WITHIN $\frac{3}{4}$ OF 1 PER CENT



G-E Type HP-3 pyrometer provides temperature indication and 2-position control of heating apparatus.



Heart of G-E pyrometers: This sturdy indicator assembly has heavy alnico magnet and lightweight armature.



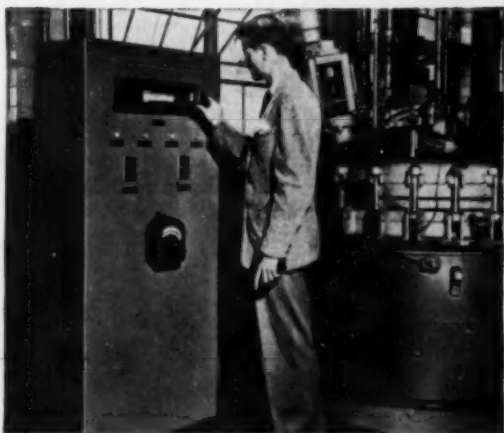
## PYROMETER EQUIPMENT

The new G-E pyrometer has an exceptionally high accuracy— $\frac{3}{4}$  of 1 per cent of full scale. But it also has the ability to hold this accuracy despite shock and vibration. The reason is the inherently sound construction. The instrument has a powerful, heavy ( $3\frac{1}{4}$  lb), alnico magnet and a featherweight (one gram) moving coil. This combination (high torque and low weight) results in accurate performance even under the most severe operating conditions.

Other features of this new G-E pyrometer equipment include: Built-in automatic cold-junction compensation that prevents changes in ambient temperature from appreciably affecting performance; gaskets at both base plate and zero-setting mechanism that keep out dirt, dust, and moisture; and an antiglare glass cover fitted over a seven-inch antiparallax scale that makes a G-E pyrometer easy to read.

This new equipment is made in indicating, protecting, and two- and three-position control forms. It is available in a variety of standard temperature ranges in the 0-3000 F span. For complete details, write for Bulletin GEC-713. General Electric Company, Schenectady, New York.

*Also available: a complete line of thermocouples.*



Control unit of HP-3 pyrometer being inspected. The HP-3 is used here with a compound vacuum-treating tank.

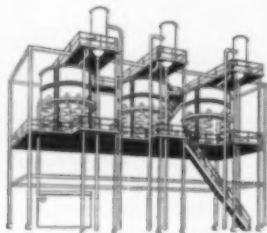
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607-204



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Acid Recovery Department  
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What to do with spent sulphuric acid is a problem that has long plagued the chemical processing industry. Some plants have found acid recovery profitable, moneywise. Others have found reclamation advisable, community-wise. All agree that some solution is essential.

If you've decided to recover your spent acid, whatever the motivation, make the move to gain *two* desirable ends — one, acid efficiently concentrated for re-use; two, a recovery operation that is fumeless. A further consideration, obvious to large acid users, is the current need for conservation of sulphur.

The *Simonson-Mantius Vacuum Process* is the means to these ends. By recovering acid in closed vessels, *under vacuum*, this process not only reduces acid losses but also eliminates obnoxious fumes.

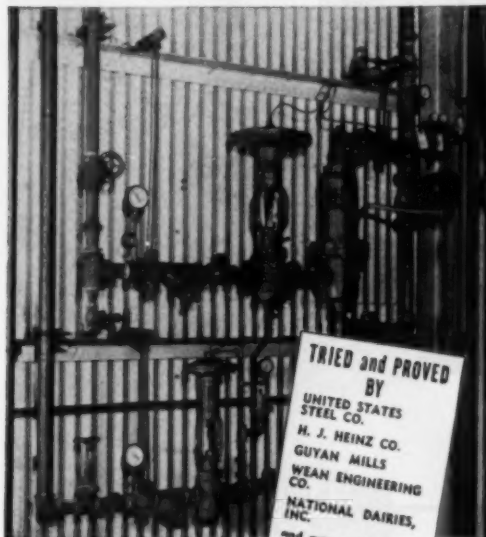
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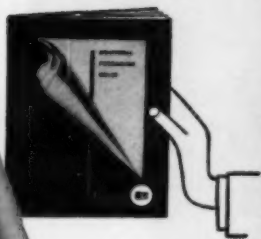
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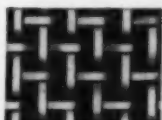


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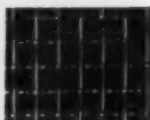
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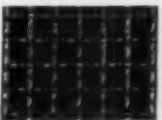
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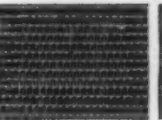
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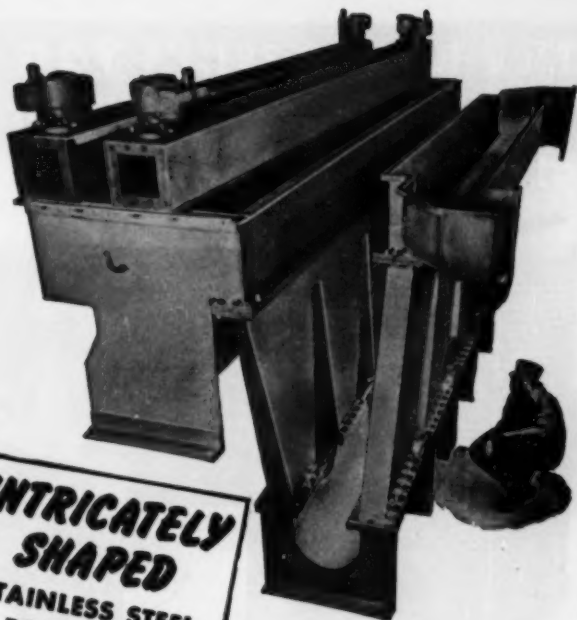
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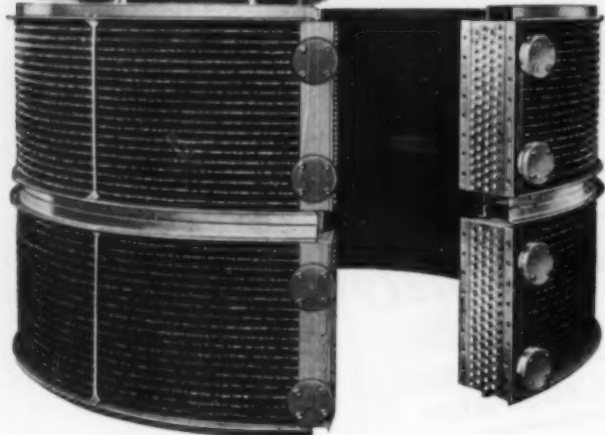
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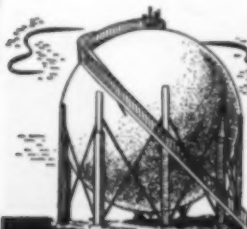
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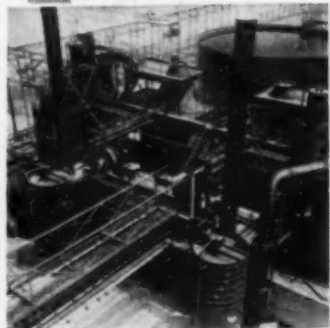
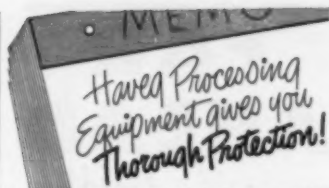
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*System three* consists of the extraction filters. Two **DAY** Type "AC" Dust Filters are connected in parallel and recover dust from the hull cyclone and the meal cooler cyclone.

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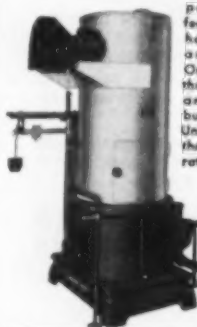
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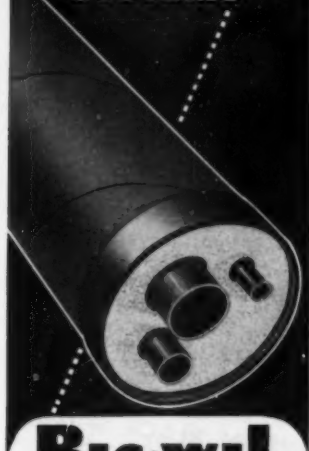
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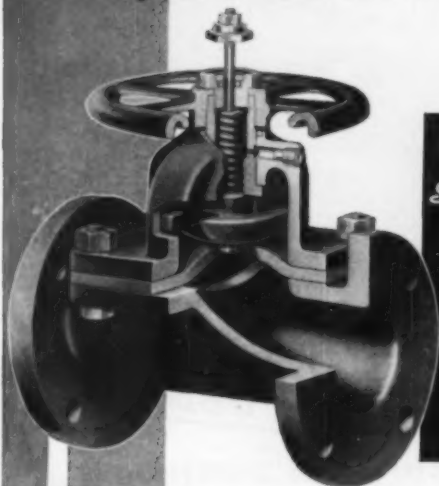
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Sulphuric acid up to 66° Bé can now be valved without leakage, dripping or sticking . . . with Hills-McCanna Diaphragm Valves equipped with the new L-1 plastic diaphragms. This new development combines the tried and proved Saunders Patent pinch clamp principle with a diaphragm of a special type of plastic that is particularly resistant to concentrated sulphuric acid.

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Literature is available describing Hills-McCanna Valves with data on their use for acid and other services. Write for your copy outlining the nature of your application. HILLS-McCANN COMPANY, 2341 W. Nelson St., Chicago 18, Ill.

The valve illustrated in cut-a-way above is the Hills-McCanna Model #600 semi-sealed bonnet acid valve with L-1 plastic diaphragm and tell-tale travel stop indicator. Valves of this type can be furnished where particularly rigid safety precautions must be taken.

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# DUST

CHEMICALS in Quebec

ALFALFA in Alberta

BENTONITE in Wyoming,  
South Dakota

CEMENT in Kansas,  
Oklahoma

WOOD FLOUR in Maine

CHEMICALS in New Jersey,  
Pennsylvania

TOBACCO in Virginia,  
Kentucky

GRANITE in North Carolina

CHEMICALS in California

CARBON BLACK in Texas

SUGAR in Georgia

OYSTER SHELL in Florida

— just a few representative  
dusts collected in thousands of

## SLY DUST FILTERS

• Sly pioneered and leads in  
industrial dust control.

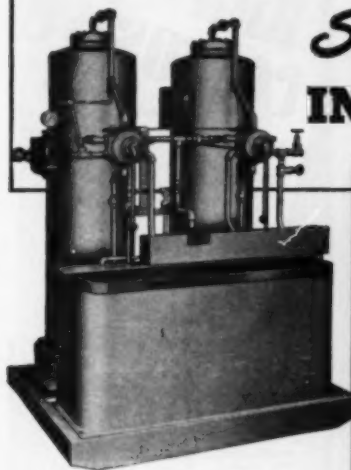
Sly representatives are trained  
and experienced engineers.

Your dust problem, large or  
small, can be solved by a Sly  
dust expert.

**THE W. W. SLY MANUFACTURING CO.**  
4771 Train Avenue • Cleveland 2, Ohio  
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## ion exchanger

### *Suggestions by* **INDUSTRIAL**



A Two-Bed INDUSTRIAL Ion-Exchange Unit. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

Demineralization of Water

Deacidification of Solutions

Purification of Organic Solutions

Recovery of Valuable Metals from Solutions

Concentration of Solutions

Substitutions of Anions and Cations in Solutions

The success stories of ion exchangers are not isolated cases. All through industry in a wide variety of applications they are effecting substantial cuts in costs, more uniform products, and a new ease in process control.

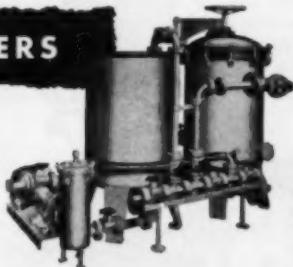
Here are a few suggestions for you to check against your own processing. INDUSTRIAL is glad to give you the benefit of its experience if you will outline your requirements. An estimate of probable savings, production, approximate costs, and the equipment required will enable you to know what the ion-exchange method can do for you.

## INDUSTRIAL FILTERS

### For Solution Clarification Any Solution—Any Quantity

A Typical INDUSTRIAL Stationary Filter. Standard portable and stationary models available with capacities of 100 to 15,000 gph. Special filtering systems are engineered to meet unusual requirements.

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FILTERS PUMPS CORROSION TESTING APPARATUS  
Pressure Type Centrifugal Salt Fog Humidity

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Vulcanized Linings • Molded Products • DEMINERALIZERS

do humid days

do this...



...or that  
to your Product?

ON THE PRODUCTION LINE

Sylvania Hosiery Mills, at Ephrata, Pa., where m'lady's fine nylon hose originate, had this very same production problem on humid days. Nylon thread stretched, became sticky and unworkable. KATHABAR, the true humidity control system for comfort and process atmospheres, eliminated this production bottleneck—assured weather-proof production schedules—saved countless dollars previously lost by quality irregularity. The controlled-humidity atmosphere for nylon, of 80°F and 30% relative humidity, gave employees personal comfort, too.

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The **Kathabar** system of humidity control for industrial processes and comfort offers you:

★ FLEXIBLE OPERATION—Prescribed humidity level maintained regardless of outside conditions—humidifies as well as dehumidifies.

★ DEPENDABILITY—Few moving parts—system serviced while in operation—non-corrosive solution.

★ EASE OF INSTALLATION—Simple duct arrangement—compact and lightweight—minimum assembly required.

★ ECONOMY—Extra low operating cost—needs no licensed engineer.

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MANUFACTURED BY  
**Surface Combustion CORPORATION**  
TOLEDO 1, OHIO

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Kathabar Division  
TOLEDO 1, OHIO

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ALUMINUM  
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Strapping Tools for applying.

**FREE**  
Handy calculator  
—one side tells  
you which strap  
to use for any  
given corrosive  
condition; other  
side determines  
length and weight  
of strap required  
for any binding  
operation.



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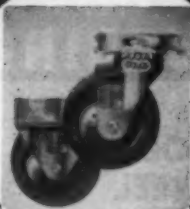
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Floors, Equipment  
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these low-cost  
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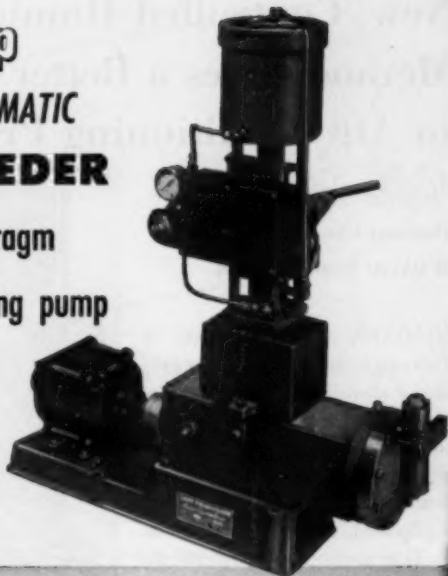
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## **AUTO-PNEUMATIC PULSAFEEDER**

piston-diaphragm  
chemical metering pump  
with automatic  
output control



For automatic metered pumping of corrosive or "hard-to-handle" chemicals, the Lapp Auto-Pneumatic Pulsafeeder offers new accuracy, efficiency and dependability. Applicable to all pneumatic or electro-pneumatic instrumentation, the Auto-Pneumatic Pulsafeeder provides automatic metering in response to variable flow, pH, temperature, liquid level, pressure, or other processing variables. The Pulsafeeder accomplishes this with a pump that operates at a constant pumping speed; variable flow results from variation only in piston stroke length, controlled by the pneumatic cylinder. In addition, through a manual ratio control, means is provided for accurate adjustment of output rate independent of instrument air pressure changes. And the Lapp Pulsafeeder is the positive displacement proportioning pump that operates without stuffing box or running seal. Its hydraulically-balanced diaphragm acts as a floating partition which isolates the chemical being pumped from pump parts—to protect against contamination of product or equipment. Entire mechanism inherently explosion-proof.

**WRITE** for complete description and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 402 Maple St., LeRoy, N. Y.

# **Lapp**

**PROCESS EQUIPMENT**

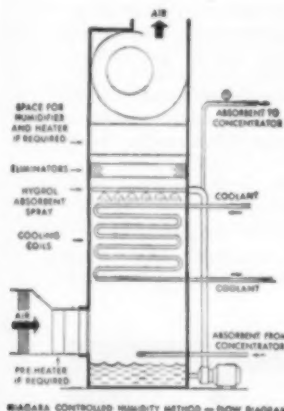
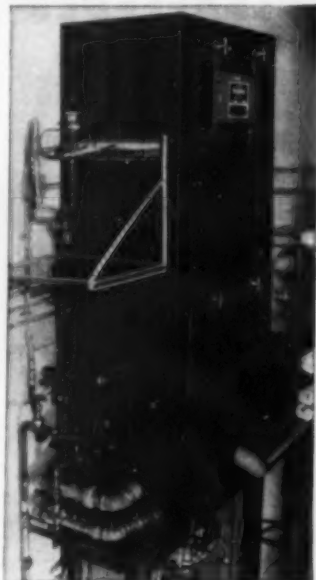
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PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

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*"Hygrol" Absorbent Liquid  
Dehumidifies Fresh Air  
Without Refrigeration*

NIAGARA Air Conditioners or Dehumidifiers using "Hygrol" liquid absorbent give precise control of air temperature and humidity... at lower operating cost, with large savings in space and with smaller and less expensive equipment, in many applications.

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NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

*Write for Bulletin 112*

## NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. CE, 405 Lexington Ave.

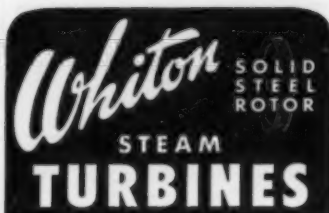
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air conditioning and assuring always a constant dehumidifying capacity and a trustworthy, constant condition for your material, apparatus, process or room to be conditioned.

"Hygrol" is a liquid, not a salt solution; it stays pure and non-corrosive; it does not cause maintenance or operating troubles in food plants or in chemical processes.

Investigate this new Niagara Method for "comfort" air conditioning as well as to protect quality in hygroscopic material, or processes or instruments, or to prevent condensation damage to metals, parts or products.



With  
**SOLID  
STEEL  
ROTOR**

**ASSURES . . .**  
LONGER, EFFICIENT  
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**ELIMINATES . . .**  
COSTLY BREAK-DOWN  
AND REPLACEMENTS

Designed to your specific requirement.

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### SHREDDING CITRUS PEELS

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**OTHER WASTE PRODUCTS** handled by the Pre-breaker and Disintegrator such as sugar beets, grape stems, cannery waste.

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technical bulletin  
on this application.*



**Rietz MANUFACTURING CO.**

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**THESE INFILCO TREATING PLANTS ABATE POLLUTION TO  
MEET STATE BOARD REQUIREMENTS ECONOMICALLY**

Ohio and Pennsylvania are making rapid strides in returning rivers and lakes to their natural state by cleaning up industrial plant effluents . . . and Infilco Equipment is helping them to do it!

The industries shown here have found the installation of Infilco Equipment the *best* solution to their waste treatment problems. Many of the plants are recovering by-products or clarified water to defray operating expenses. Infilco can help you with your waste disposal problems with 57 years experience and a complete line of equipment for chemical and biological treatment. Call in the nearest Infilco field engineer or write to our Tucson offices.

Bulletin 70-A describes Infilco Equipment and its waste treatment applications. Send for it today.

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**TUCSON, ARIZONA**

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TREATMENT EQUIPMENT THAT'S**

*Quality Engineered for  
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# ARE YOU USING THE *Right* METALLIC FILTER CLOTH for *Your* FILTRATION

If you are in doubt or would like to try another style weave, write us in detail about your filtration step. We make all five of the standard weaves mentioned above. We are in position to turn out special weaves, if necessary. And we make cloth from all malleable metals, including the noble metals.

All Newark Metallic Filter Cloth is manufactured in a wide range of meshes. It is available in rolls, cut and gasketed to fit your filter presses, or made up into filter elements. We have large stocks of standard weaves on hand to make prompt shipment.

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for ACCURACY

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V-25 Gas Fuel Governor



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K-10 Magnetic Lever Valve



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*Manufacturers of automatic Pressure, Temperature, Level and Flow Controls*

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YOU WANT TO  
PULVERIZE*

We'll make  
a test grind  
with



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You will receive our Engineering Report suggesting the best method to use and the type of Schutz-O'Neill Pulverizer and any receiving or sifting equipment suited to your requirements.

SCHUTZ-O'NEILL offers you the benefit of more than a half century of experience in rapid, accurate, dustless pulverizing of any dry, grindable, non-gritty stock.

SCHUTZ-O'NEILL Pulverizers are made in 6 sizes with capacities up to 2000 lbs. per hr. Also Gyrator Sifters, Roller Mills, Receiver Boxes, Collectors, Hammermills, etc.



*When sending sample, be sure to state quantity desired.*

**SCHUTZ-O'NEILL CO.**

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“Dependable”  
is the word  
for Wyandotte

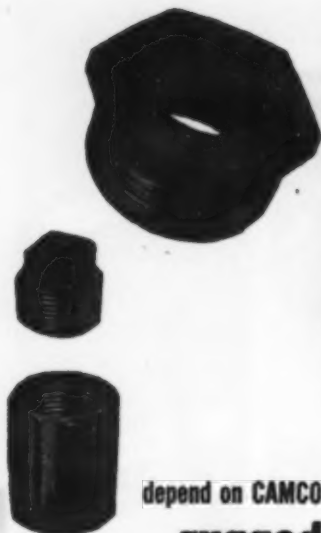
SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA  
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**rugged**  
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stainless steel pipe fittings  
to solve your  
corrosion problems

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These fittings—sold at same price as competing 150 lb. cast fittings—can be used where working pressures of up to 1000 lbs. are experienced.

These stainless steel fittings are available in Types 304, 316 and 347.

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Please send your latest catalog.

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## LIMESTONE OF QUALITY . . . BILLIONS OF TONS IN QUANTITY

A manufacturer requiring good limestone has only to look at Oklahoma - - and he will find what he needs. For limestones are widely distributed over the entire state.

In the Arbuckle Mountains, limestone deposits have a combined thickness of about 8,000 feet (if the dolomites are included). Physically, Oklahoma limestones range from friable or chalky to stone with maximum crushing strength; from coarsely crystalline to very fine-grained; and from minutely oolitic to coarsely pisolitic. Chemically, they range from impure stone suitable for woolrock to chemical grade.

Oklahoma limestone is being utilized extensively for many purposes. Its quality and availability merit consideration for a multitude of additional uses.

### TYPICAL ANALYSIS

(26 feet)

	Percent
CaO . . . . .	54.760
MgO . . . . .	8.680
SiO <sub>2</sub> . . . . .	0.143
Fe <sub>2</sub> O <sub>3</sub> . . . . .	0.074
Al <sub>2</sub> O <sub>3</sub> . . . . .	0.174
P <sub>2</sub> O <sub>5</sub> . . . . .	0.007
SO <sub>3</sub> . . . . .	0.008
Ignition loss . . . . .	43.940
Total . . . . .	99.786

Detailed information on Oklahoma's mineral resources is available on request, based on data by the Oklahoma Geological Survey. Map showing location of mineral deposits is also available.

MINERAL  
RESOURCES



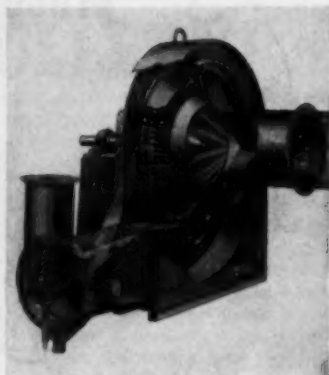
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PLANNING AND RESOURCES BOARD  
STATE CAPITOL BUILDING  
OKLAHOMA CITY, OKLAHOMA

*today's best buy is better air!*



Type W Roto-Clone Arrangement A "space-saving" installation



Type W Roto-Clone cutaway to show water sprays combined with dynamic precipitation to provide high efficiency wet collection.

## CLEANER CHEMICAL PROCESSES

### by ROTO-CLONE "Engineered Dust Control"

**D**UST dilemmas in the chemical and pharmaceutical industries have more horns than a hat rack. The problems are as varied as the chemicals or ingredients processed and the processes used, so . . . no one piece of equipment could possibly function adequately on all jobs.

AAF Roto-Clones®, however, in their many types, sizes and arrangements allow "engineered dust control" and have solved practically every kind of dust problem in these industries. Available in both wet and dry types, Roto-Clones provide high efficiency collection over a wide range of particle sizes from coarse to extreme fines. They also economize on space

as in the coating pan installation above, leaving more room for production operations.

If you have dust problems involving blending, coating, drying, milling, polishing, screening or other operations . . . including salvage of materials . . . Roto-Clone "engineered dust control" will provide a solution based on broad, practical experience in specific installations.

For complete information see your near-by AAF representative and write for Engineering Bulletin No. 270 A.

\*ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

SOME OF THE MANY  
DUST SOURCES  
EFFICIENTLY CONTROLLED

by

#### ROTO-CLONE

BLENDED  
COATING  
COMPRESSING  
CONVEYING  
FILLING  
HAND MOLDING  
PACKAGING  
SCREENING  
SHAKING  
WEIGHING



**American Air Filter**  
COMPANY, INC.

326 Central Ave., Louisville 8, Kentucky

• In Canada: Darling Bros., Ltd., Montreal, P. Q.

## how to chemically deactivate process water...



# the *Versenes*\*

### WATER IS A CHEMICAL

Ordinary process water must always be regarded as an *active chemical*. Only c.p. water is an *inert ingredient*. This is why it is always necessary to consider ordinary process water as a chemical in itself. Those who fail to do this are often confronted with many troublesome contamination problems and complaints.

### VERSENE\* DEACTIVATES CONTAMINANTS

The Versenes are powerful organic chelating (complexing) agents. They are known chemically as the sodium salts of ethylene diamine tetra acetic acid and other polyamino acids. They give you exacting mathematical control over cations in solution. By keeping these troublesome metallic ion contaminants in soluble complex form, they actually deactivate them and prevent the occurrence of undesirable reactions in *any* wet chemical process.

### VERSENES\* ARE VERSATILE

When you suspect that your processing problem is due to contamination and may be traced to the process water used — it's time to investigate the Versenes. Perhaps you had better do it now. Write Department B. Ask for samples and Technical Bulletin No. 2.

\*Trade Mark

*"industry's most  
modern chemicals"*

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Providence Agent: George Mann, 231 Fox Point Boulevard,  
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W. Coast Agent: Griffin Chemical Co., San Francisco, Los Angeles

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Associated Chemical Co. of Canada, 14 Derrell Ave., Toronto, Ontario

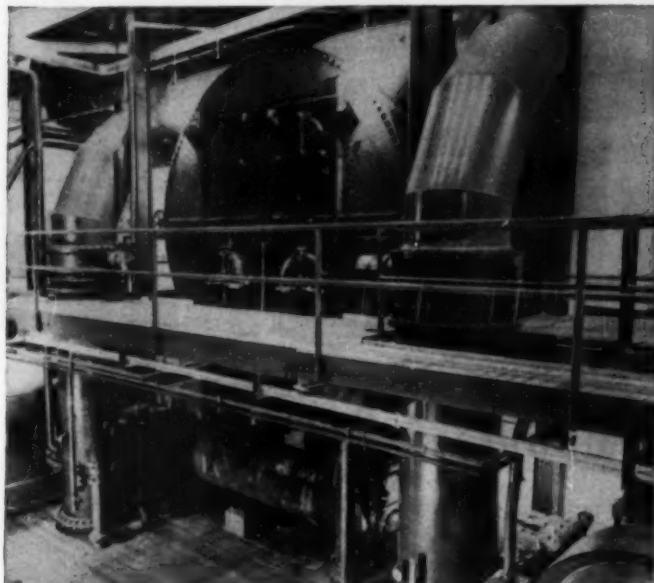
BRIDGEPORT BRASS COMPANY  
CONDENSER AND HEAT EXCHANGER TUBE EDITION

# COPPER ALLOY BULLETIN

BRIDGEPORT  
"Bridgeport"  
INC.

MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

## Conserving Condenser Tubing Tube Conservation Program



A 33,000 sq. ft. divided flow condenser installed in the New Castle, Penna., plant of Penn Power Company. Courtesy Condenser Service & Engineering Co., Inc., Hoboken, N. J.

Operators must be more alert today to extend the life of condenser tubes by carrying out a more careful and more frequent inspection and maintenance program regardless of the higher costs involved.

The factors which are responsible for accelerated corrosion attack should be determined and steps taken to counteract them. Close recording of tube failures should be made. Frequent removal of mud and debris from intake tunnels, screens, water boxes and tubes should not be neglected to prevent foreign matter from entering and doing damage. Chlorination and cleaning should be performed regularly to keep marine growth and slime to a minimum. In some cases, where impinge-

ment or erosion are serious, coating the inside of the tubes with a protective material six to eight inches from the inlet end has proved helpful.

### Vibration Causes Trouble

Excessive vibration can lead to corrosion fatigue cracking of tubes. Pulsating streams of liquids or gasses striking the tubes at high velocities frequently start tubes vibrating. Vibration of compressors, pumps and adjacent equipment also may start some of the tubes vibrating. These sources of trouble should be checked to prevent such tube failures.

If troubled by air impingement or erosion at the inlet end, flowrites should be installed before the damage

becomes serious. A careful study should be made to determine the causes of impingement attack—stopping air leaks in pumps and supply pipes, reducing turbulence at the inlet end, removing silt, venting or installing de-aerator screens in front of the tube sheet if necessary to remove entrained air and other gases.

### Study Water Velocity

A check on the velocity of the cooling water may also lead to beneficial changes in operating procedure to protect tubes. Impingement corrosion, caused by exceedingly high water velocity, is universally recognized. However, low velocity has permitted debris, slime and other foreign matter to adhere to tube walls in many instances. When the velocity was increased the condition was corrected except in cases where the foreign matter had gained too much of a foothold.

### The March, 1950 Bulletin

A tabulation giving suggestions for keeping records of tube performance, controlling foreign matter, various cleaning methods in use, checking vibration and storage of spare tubes is found in the March, 1950 issue of the Copper Alloy Bulletin. A reprint will gladly be mailed upon request.

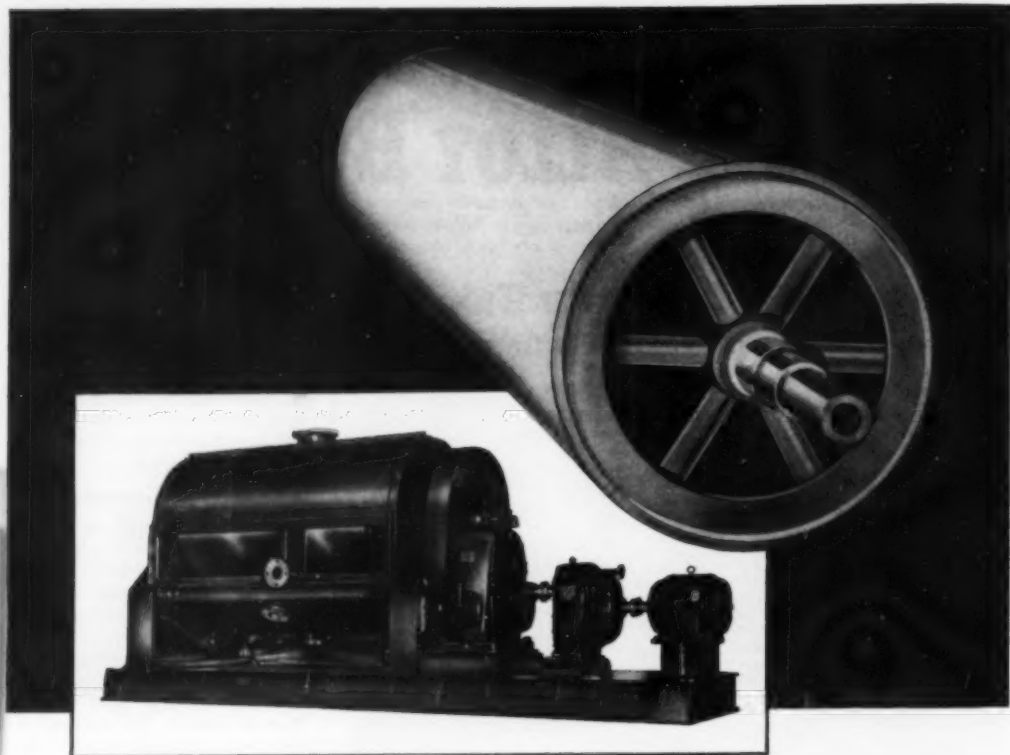
In the interest of conserving condenser and heat exchanger tubes, the experience of our Corrosion Laboratory is available to operators of power plants, ships, refineries and process plants. (6451)

### Bulletin Reprints Available

Reprints of the Condenser Tube Edition of the Copper Alloy Bulletin will be sent regularly to those who request that their names be added to the mailing list. Copies of some back issues are also available.

Write to Bridgeport Brass Company, 30 Grand Street, Bridgeport 2, Conn., attention Editor Copper Alloy Bulletin.





## New Design Flaker Shaves Production Costs

Production of a new insecticide required high output with close control of temperatures, and protection of product to maintain quality. To solve the manufacturer's problem, Lukenweld designed and built a single-roll flaker.

This unit with nickel-clad steel steam jacketed dip pan and solid nickel agitators holds and protects the molten material which rapidly crystallizes on a chrome-plated jacketed steel roll through which water circulates. Crystallized material is then scraped off by a doctor knife. Fast flaking under carefully controlled temperature, and prevention of metallic pick-up assure a quality product. Complete success of the first install-

ation resulted in additional units being ordered.

The effectiveness of this and similar installations is due, in large measure, to the use of Lukenweld Jacketed Steel Rolls. Because of their double-shell steel plate construction they deliver more even temperatures across the entire face of the roll, whether for cooling or heating operations.

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Fig. 2453 G—Large size 150-pound Stainless Steel Gate Valve. Flanged ends, bolted flanged bonnet, outside screw rising stem and yoke. Accurately guided, interchangeable solid or split wedges can be furnished. All dimensions of flanged end valves conform to MSS Standard SP-42. Available in a large selection of Corrosion-Resisting Metals and Alloys.

Fig. 1944—Large 150-pound "Y" Valve with flanged ends, bolted flanged yoke-bonnet and outside screw stem. Shown in Stainless Steel. Available in many other Corrosion-Resisting metals and alloys.

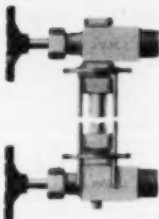
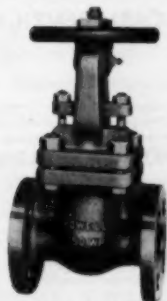


Fig. 1885—Screwed-end Liquid Level Gauge. Furnished with 1/2" I.P.S. male pipe ends with 1/4" glass, or 3/4" I.P.S. male pipe ends with 3/4" glass. Can be supplied with safety ball check, when specified. Made in Stainless Steel and other alloys.



Fig. 1847—Small 200-pound Swing Check Valve with screwed-in cap and regrindable, renewable disc. Shown in Stainless Steel and available in a variety of other corrosion-resisting metals and alloys.



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1—6" x 24", 3 Pair High, Steel Roller Mill.  
 3—Hochsilo 10" x 30", 4 Roll Granite Stone Mills.  
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 7—Baker-Perkins heavy duty double arm Jack. mixers 200, 100, 50 & 25 gals.  
 12—Horiz. Mixers 35 to 200 gals., single & double arm.  
 6—Pony or Paulo Mixers, 8, 15 & 40 gals.  
 1—Century 2 HP, 4 speed Vert. Mixer.  
 4—Load & Paste Mixers 50 to 150 gals.  
 4—Simpson Intensive Mixers 20 to 3-1/2.  
 1—Master Drum Type Blender 1000P.  
 10—Dry Grind Mixers 50 to 2500P.  
 12—Portable Elec. Liquid Mixers 1/4 to 3 H.P.

**SCREENS & SIFTERS**  
 2—Tyler 230 1/2" Hammer Screens, 20"x30".  
 1—Rotex Sifter 20"x30", 4 Surface.  
 6—Rotex Sifters 20"x30" to 40"x60".

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 9" by 23"—12" by 36"—16" by 40".  
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- 3—Sharples 26", steel.

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- 2—Sperry Type, 20"x20" Recessed, 25 chambers.
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- 1—Shriver 12"x12" P&F, 12 chambers.
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- 1—Raymond #45 Imp Mill.
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- 1—Abbe 5"x8" Manganese Jacketed Ball Mill.
- 8—Abbe 8"x8", 36"x42", 35"x36" Pebble Mills.
- 6—Patterson 4"x5", 3"x4" Pebble Mills.
- 2—Mikro Pulverizers #2TH, #15R.
- 5—Colloid Mills 8", 4" dia., S.S.
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- 1—Jeffrey 20"x12" Type B Hammer Mill.
- 8—Hardinge Mills 8"x22", 6"x22", 5"x36", 5"x22", 4½"x18".
- 3—Day 16"x40", 12"x30", 9"x24", 3-Roll Mills.
- 1—Raymond 8' Air Separator.
- 2—Simpson Intensive Mixers #1½, #9.

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- 1—Robinson 40"x84" Stainless Single Deck.

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- 1—13,000 gal. Hor. 9'x32"x½/16".
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- 1—8'x48' Rotary Dryer, ¼" shell, 1/16" monel.
- 1—4'x80' Rotary Dryer.
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- 1—P&S Conveyor Dryer, 8' wide x 32' long.
- 5—Atmospheric Double Drum Dryers, 42"x120", 32"x100", 32"x90", 36"x84", 30"x32".
- 5—Single Drum Atmospheric, 5'x12', 4'x9', 4'x6".
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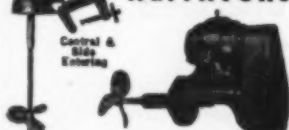
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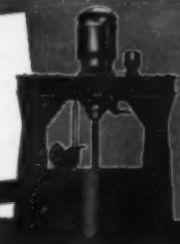
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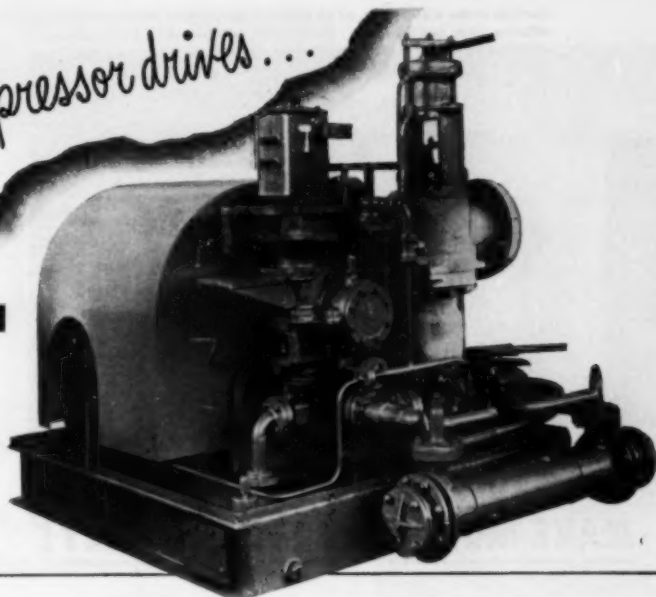
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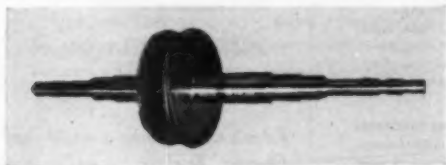
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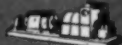
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TO. 4

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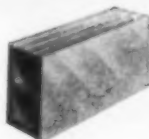
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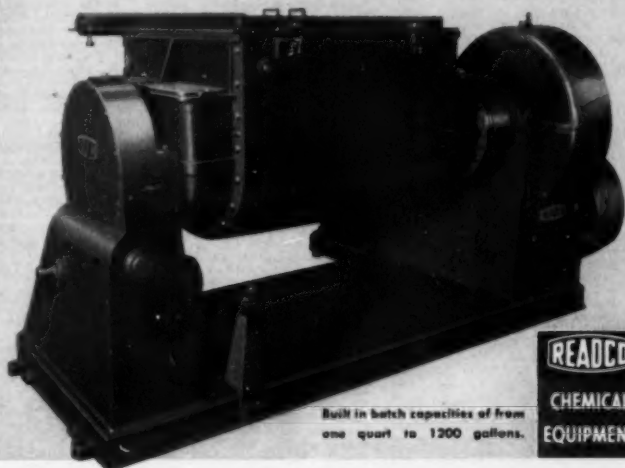
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# Chemical Engineering Reader Service

## HOW IT WORKS

Mail the postcard below. Before mailing, circle page numbers of items about which you want more details. Then write your name and address on other side of card and mail to us. Your requests will be forwarded to companies concerned, the answer coming direct to you.

## TO MAKE IT HANDY

Products and literature in this issue are listed on these pages. There are two indexes. (1) editorial items on new equipment, new products, new literature; (2) products advertised. The index of advertisers is on the preceding page.

## NUMBERS EXPLAINED

Advertisements:—There is a page number on the postcard for each advertisement. Before the number, may appear, L, R, T, B (left, right, top, bottom) locating the ad on the page; small letters following (a, b, c) indicate additional products in the advertisement.

Editorial Items:—Numerals are page numbers; the ABC's distinguish among items where more than one is on a page. There is a number on the postcard for each item in three editorial departments: Equipment News, New Products, and New Literature.

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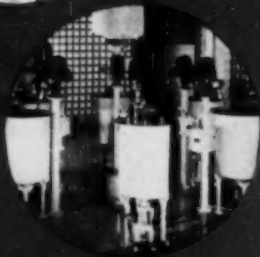
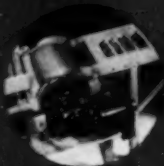
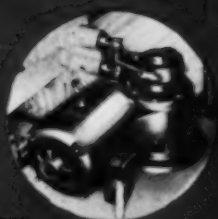
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